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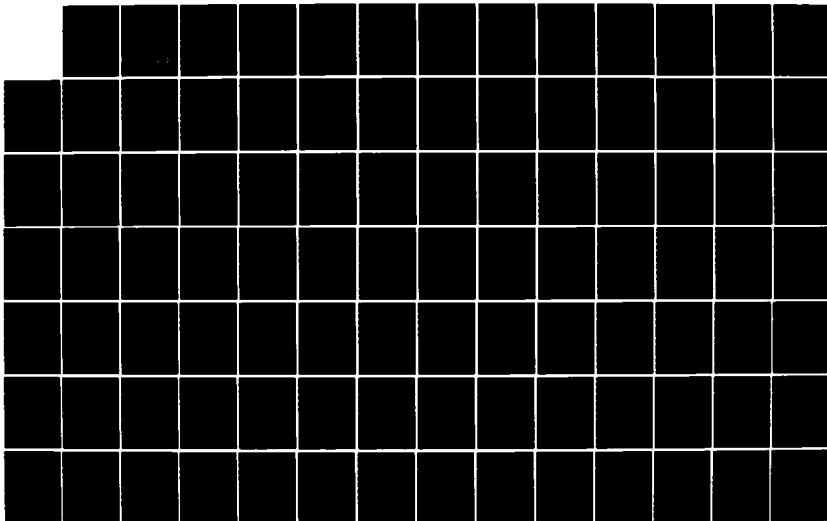
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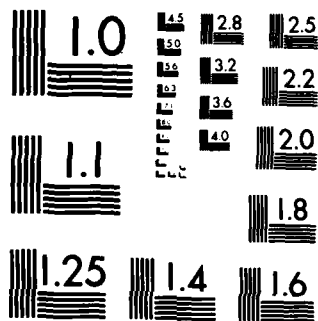
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NUCLEAR WASTE DISPOSAL: CAN GOVERNMENT COPE?

Jackie L. Braitman

December 1983



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NUCLEAR WASTE DISPOSAL: CAN GOVERNMENT COPE?

Jackie L. Braitman

December 1983

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The original version of this study was prepared by the author, Jackie L. Braitman, as a dissertation in partial fulfillment of the requirements of the doctoral degree in policy analysis at The Rand Graduate Institute. It was approved by Dr. Braitman's dissertation committee on September 13, 1982.

PREFACE

With passage of the Nuclear Waste Policy Act of 1982 (NWPA), the policy debate surrounding nuclear waste management shifted from broad issues of problem definition to the question of *how* to implement the provisions of the Act. The Act set forth a detailed schedule and institutional process for the Department of Energy to follow in disposing of high-level radioactive wastes. The process requires participation by broad segments of the public particularly affected state and tribal governments, allows for extraordinary public scrutiny by requiring special decision documents and public review; and allows state, tribal, and Nuclear Regulatory Commissions disapproval of the decision to construct a waste repository.

Among the more important implementation questions is whether the DOE can develop the management capabilities necessary to establish waste repositories.

This research examines:

- the organizational capabilities required to site noxious facilities in the face of public opposition, and
- the ability of executive agencies of the federal government, such as the Department of Energy, to develop requisite siting capabilities.

Noxious facilities include petrochemical plants, oil refineries, nuclear and hazardous waste sites and other facilities which few of us want in our "backyards." The analysis draws on two cases: The Department of Energy program to dispose of high-level nuclear wastes and the program of a large oil company to site petrochemical plants. The public/private comparison is a device for examining the importance of differences in the mechanisms for control and influence available to actors outside the organization.

The research suggests that neither a federal agency nor a private corporation can be expected to succeed in developing the necessary management capabilities. This is a particularly important finding for the current policy debate regarding the appropriate management arrangements for nuclear waste management. A hybrid organization must be designed in order to increase the chances of succeeding at this difficult task.

The paper reproduces the text of the author's doctoral dissertation, which had the title "Relative Capabilities of the Public and Private Sectors To Site Noxious Facilities." The dissertation was completed in August 1982 and signed by all committee members in September 1982. Delay in publishing the work resulted from unsuccessful efforts to find additional funding to extend the research and publish it as a commercial book.

The research was sponsored by The Rand Corporation and The Ford Foundation.

December 1983

SUMMARY

The research reported here is a device for considering whether the Department of Energy can succeed in siting nuclear waste repositories through marginal program and legislative changes or whether more fundamental changes in the mechanisms for public control are needed. The analysis presented here strongly suggests the need for fundamental changes if public responsibilities, such as nuclear waste disposal, are to be met.

The work originates from a supposition that the failure, thus far, of the Department of Energy (DOE) to site and develop repositories to dispose of high-level radioactive wastes results less from the management style or competence of individual government managers than from the specific set of requirements and mechanisms for accountability which we, as a society, impose on executive agencies. In order to develop and test this hypothesis, I compare the ability of an executive agency (the DOE) to develop the requisite capabilities for siting noxious facilities with the ability of an organization which faces radically different requirements for public accountability: a large oil company attempting to site a noxious facility. The purpose of the private/public comparison is not to compare the relative performance of the two sectors. Rather, it is a way of comparing how different environments and incentives affect organizational performance.

Obviously, firm conclusions cannot be drawn based on the two cases studied. In many ways the cases represent different siting problems. The siting of HLW repositories is much more difficult than the siting of petrochemical facilities. Repositories require pioneering technology which is not well understood by the public and has not yet been demonstrated to protect public health and safety. Moreover, issues involving potential radiation hazards are matters of scientific controversy and, importantly, generate public concern and emotion. Many consider even low levels of radiation an unacceptable risk while fewer want to eliminate chemicals from their environment. The siting of repositories has a longer "critical path" than the siting of

petrochemical facilities. Finally, surrounding the siting of repositories are controversial societal issues such as the continued generation of electricity through nuclear power and the nuclear weapons program.

Not only do the two cases represent different siting problems but they also entail different societal goals. Disposal of hazardous substances, and notably disposal of radioactive wastes, falls within the governmental responsibility to protect public health and safety and the environment. In such areas, authority and responsibility are placed within the public realm to assure that nonmonetary and noncommensurable goals are balanced according to the checks, balances, and compromises which are part and parcel of the political system. In executive agency siting programs, public control is largely exercised through reliance on procedural regularity and fairness, frequent review by the congress and by interested groups of programs, funding levels, and activities, easy access to information by groups outside the agency, and limited statutory authority.

Why Siting is Difficult

The primary obstacles to siting of noxious facilities are posed by groups and individuals outside the siting organization whose interests are adversely affected by the proposal and who employ available procedural and legal avenues to oppose development. Opposition usually comes during the siting process.

Any organization which is to succeed in developing facilities such as HLW repositories will need an unusual set of capabilities. It will need, in addition to technical capabilities:

1. a good and *continually evolving* understanding of the concerns (technical and nontechnical) of national, regional, state, and industry constituencies;
2. an ability to decisively negotiate with these individuals and groups on both broad policy and detailed operating issues and decisions;

3. the ability to create programmatic stability in the face of changing information and external demands; and
4. the capability to weigh many incommensurate factors, in the public limelight, in reaching timely, broadly acceptable, and technically supportable decisions.

This is an impressively difficult and unusual set of capabilities.

Three hypotheses are developed and "tested" regarding the relative capabilities of the public and private sectors to site noxious facilities. The hypotheses draw heavily on literature from diverse fields including public and business administration, facility siting, and implementation. I hypothesize that;

1. Executive agency siting program managers will tend to be inflexible in their response to the external environment as a result of (a) the likely failure of political officials to delegate authority to operating officials to resolve conflicts along with guidance about the acceptable terms of compromise and (b) reliance by executive agency operating officials on decision rules and procedural regularity.
2. Public managers of controversial programs will be unable to balance competing and noncommensurable objectives. Private managers will treat external concerns as constraints on cost minimization objectives not by balancing the competing public values which lead to public opposition to facilities.
3. Federal siting policies will tend to be unstable over the length of time required to site a noxious facilities.

Evidence in support of these hypotheses is provided by examining the siting process and outcomes of two siting programs: the DOE program to site high-level waste repositories and the program of a major oil company to site petrochemical facilities.

Findings

Notwithstanding similar conceptual approaches to conflict resolution by the two organizations studied, this research supports the sense of the above hypotheses: Neither private companies nor federal executive agencies will be able to develop the full range of capabilities necessary to site controversial noxious facilities in the public interest.

The constraints facing federal agencies arise from the mechanisms for assuring public control and oversight. These mechanisms result in certain patterns of delegation of authority, conflicting policy objectives and priorities, and inflexible administrative procedures. The structure of the Department and other federal executive agencies evolved to handle a diverse set of programs and problems which affect individual rights, property, health and welfare. For the vast majority of federal programs, decreased flexibility is generally considered a fair exchange for the protection of individual rights afforded by due process and extensive checks and balances. Resulting lack of flexibility and responsiveness in the nuclear waste program, though, makes it impossible to reach the concrete goal of developing waste repositories.

The private sector can develop the requisite program flexibility but is unable to develop methods to balance competing public values. Instead, public values which compete with each other and private objectives are treated as constraints. External demands are met if not meeting them hurt the firm's business or would make approvals difficult to obtain. But external demands are met only to the extent that the project remains economically feasible. If a project would not provide an acceptable return on investment, a private firm can pull out. Non-monetary values, such as public health or national energy policies, are translated to return on investment. Public objectives will be met if they coincide or can coexist with the company's objectives.

In order for the federal government to successfully dispose of nuclear wastes, a new structure must be established which provides adequate due process and public scrutiny while not sacrificing flexibility and responsiveness. A new structure must be *designed*

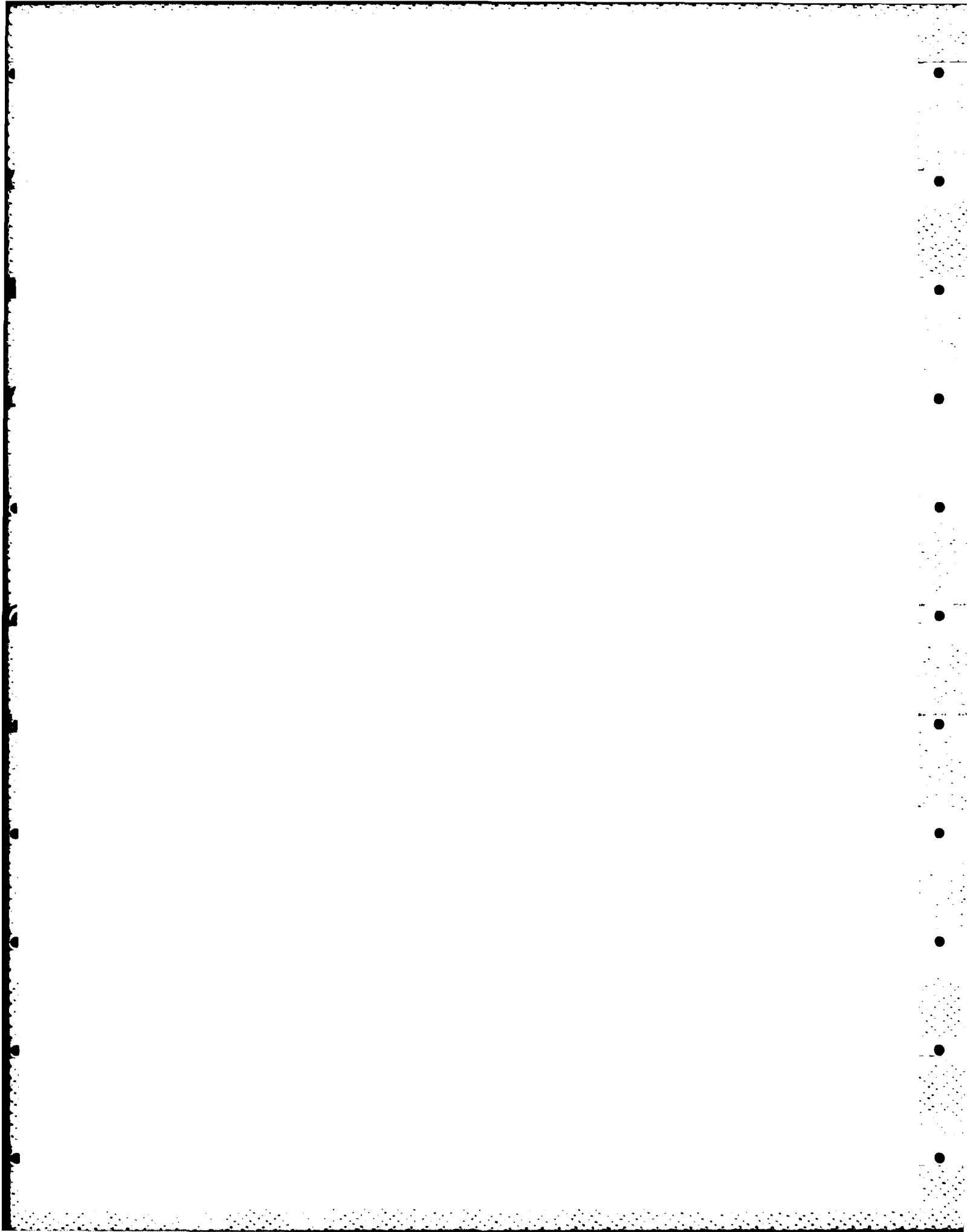
drawing on the advantages of federal agencies and private corporations but which overcomes their built-in deficiencies. One candidate is a federally chartered public corporation. The effective design of a nuclear waste authority enjoys no precedent; thus, the task requires new analysis and synthesis of as yet unapplied knowledge. This research demonstrates that organizational structure significantly influences program performance. The charter and structure of a new authority will determine whether it can develop the unusual capabilities required to perform the task of nuclear waste disposal.

ACKNOWLEDGMENTS

This research required personal interviews with numerous individuals in the private corporation which participated in the study. They have requested anonymity. While I can't thank them by name, I extend my gratitude.

David W. Lyon, dissertation committee chairman, and members Thomas K. Glennan, Jr. and Rae Archibald provided critical guidance and welcome support. Special thanks go to Charles Wolf, Dean, Rand Graduate Institute for his assistance in securing funding, guidance in developing the theoretical construct supporting my arguments, and personal support.

Any remaining factual errors and interpretation of the complex systems discussed herein remain my responsibility.



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I. INTRODUCTION

The federal government, under the lead of the Department of Energy (DOE) and its predecessor agencies, has tried unsuccessfully for the past 12 years to site and develop facilities to dispose of high-level radioactive wastes accumulating from defense and commercial activities. There is a growing consensus that this failure stems from the inability of the DOE, thus far, to resolve institutional and political controversies surrounding repository development (OTA, 1982). Past research, including a study I conducted for the DOE in 1980, concentrated on the specific requirements for implementing a repository program and the potential shortcomings of the DOE disposal program. A question raised by my previous study is whether, because of the way we, as a society, run our government, a federal executive agency is able to develop the capabilities needed to site a high-level radioactive waste repository. Lester Salamon (1981) advances a similar question in his critique of the contributions of implementation research to understanding and improving public management. In his words

... failures of public action about which so much is written may result less from incompetence ... of government managers than from the tools we have required them to use and the curious ways we have required them to act.

This study is designed to help address this question with regard to the specific task of siting noxious facilities.

The analysis compares the ability of an executive agency, the DOE, to develop the requisite capabilities for siting noxious facilities[1]

[1] For purposes of this research, noxious facilities are those industrial facilities which few of us want in "our backyards." They are

with the ability of an organization which faces radically different requirements for public accountability--a large oil company attempting to site petrochemical facilities. The comparison obviously presents analytic difficulties. Because of the scope and technical uncertainties of a nuclear waste repository development program, few, if any, activities present a fair comparison. High-level waste disposal is conceived as a national program, thus arousing a broad spectrum of national interests and concerns. Repositories require pioneering technology which is not well understood even by some scientists and has not yet been demonstrated to protect public health and safety. The task of nuclear waste management is made especially difficult because of the emotional concern over ionizing radiation and the inability to separate disposal issues from the broader issues of nuclear technology.

Let me state clearly that my purpose is not to compare the relative performance of public and private sector organizations in order to recommend which sector should have responsibility to develop noxious facilities. Many functions are assigned within the public sector specifically because the set of societal objectives surrounding that function entail noncommensurable interests and ideals. There are a great number of activities, among which nuclear waste management might be included, that are placed within the political process because moral action for the good of society as a whole is the desired outcome, where

facilities which are not for the specific benefit of the host community (e.g., community sanitary land fills) and which present the (real or perceived) potential for catastrophic or chronic health and safety problems. Excluded are facilities designed to extract or process minerals or fuels and whose location is restricted to one or very few locations, such as off-shore drilling sites, coal mines, and synthetic fuel plants.

we, as a society, want the checks, balances, and compromises inherent in political bargaining among interest groups to dominate questions of efficiency and cost (Buchanan, 1962; Wildavsky, 1964). In executive agency siting programs, public control is largely exercised through reliance on procedural regularity and fairness, frequent review by the congress and by interested groups of programs, funding levels, and activities, easy access to information by groups outside the agency, and limited statutory authority. Public control can also be exercised through substantially different mechanisms--for example, environmental regulation. Thus, it is important to determine whether the DOE can succeed through marginal program or legislative changes or whether more fundamental changes in the mechanisms for public control are needed.

CONTRIBUTION TO THE POLICY PROCESS

The findings reported suggest that the federal responsibilities for programs such as disposal of high-level radioactive wastes must be fundamentally restructured if we, as a society, are to meet public responsibilities including the safe disposal of radioactive wastes. The research does not identify specific forms for public sector organizations which could be expected to develop the necessary capabilities to overcome external opposition; that is beyond the scope of the study. It suggests the characteristics of organizations likely to be successful at siting noxious facilities and emphasizes the connection between different modes of public accountability and the requisite program capabilities for successful siting.

That a restructuring of responsibilities is appropriate is not a new idea. The suggestion has been made repeatedly. Nuclear waste management provides a good example. Mason Willrich and Richard Lester

(1977) concluded that "The existing organization for radioactive waste management is likely to be unworkable if left unchanged." They recommended the establishment of a "national Radioactive Waste Authority ... as a federally chartered public corporation." Their recommendation, advocated by many concerned with the safe disposal of nuclear wastes, became the subject of legislation introduced by Senator Charles Percy in the first session of the 96th Congress and reintroduced in revised form in subsequent sessions. In 1980, in a study preceding the one reported here, I concluded that the DOE will have difficulty implementing a program to dispose of high-level wastes. DOE lacks essential statutory authority, has not assigned organizational responsibility for responding to external opposition, and has inadequate staff and support to identify and analyze institutional and political issues and to conceptualize or initiate responsive action (Burns, 1981). Most recently, the Office of Technology Assessment (OTA) recommended, after a three-year study, that an "independent, single-purpose waste management agency" be created (OTA, 1982). The OTA study confirmed the conclusion of other studies that there were no "insurmountable technical obstacles to developing ... repositories" and that the "greatest single obstacle ... is the severe erosion of public confidence" in the federal waste disposal program. Of specific concern is the institutional capacity to carry out a "technically complex and politically sensitive program over a period of decades."

To date, none of the studies has explicitly examined the nature of the constraints on government organizations, which limit their abilities to implement politically controversial and highly technical programs, and whether the capabilities can be developed if alternative modes of

public accountability are developed. It is the purpose of this study to do so.

STUDY APPROACH AND ORGANIZATION

Siting of "noxious facilities," such as oil refineries, petrochemical plants, hazardous and nuclear waste disposal plants, and nuclear weapons basing or fabrication facilities, is difficult to accomplish successfully. Many proposed facilities have been abandoned. Well-publicized examples include a dozen or more oil refineries proposed for the northeast during the 1970s, petrochemical complexes proposed for northern California in the mid-1970s, and various potential locations for disposal of high-level nuclear wastes notably the Lyons, Kansas (1972) and Alpena, Michigan (1975) sites. Less publicized are the increased costs (transaction costs and delayed schedules) which result when unexpected external opposition occurs and must be overcome prior to construction or operation of noxious facilities. As seen from the brief examples, both private and public sector organizations have experienced setbacks in their efforts to site noxious facilities.

A major premise of the research is that siting of noxious facilities places relatively new demands on public and private sector organizations. These demands derive from the combined influences of (1) increasing public awareness and concern about environmental and public health and safety risks, (2) rapid increases in the sophistication of those concerned in using multiple avenues through which to express opposition or concern, and (3) the growth of public institutions designed to protect the environment, control industrial development, and protect public health and safety.

In this study I consider the qualities which are necessary to achieve success in responding to external opposition to siting of noxious facilities and investigate whether such qualities can be achieved by executive agencies. This analysis draws heavily on literature from diverse fields including public and business administration, siting, and implementation. Based on the analysis I suggest three hypotheses about the relative capabilities of the public and private sectors to site noxious facilities as a function of the set of mechanisms for outside control and influence facing the two sectors. Specifically, I hypothesize that (1) executive agency siting program managers will tend to be inflexible in their response to the external environment, (2) public program managers will be unable to balance competing and noncommensurable objectives, and (3) federal siting policies will be unstable over the length of time required to site a noxious facility. I then look at the outcomes of two siting programs, one in each of the public and private sectors, to provide support for these hypotheses. While this approach is not sufficient to rest my case, it provides evidence in support of the hypotheses.

The report is organized as follows. Chapter 2 examines facility siting and the special demands that implementing the location decision places on organizations. The analysis, based on available literature, suggests the nature of these demands and organizational capabilities required to meet them.

Chapter 3 analyzes the differences in the institutional environments facing executive agencies and private companies as they seek to site noxious facilities. The analysis focuses on (1)

accountability and external control of activities, (2) the nature and clarity of goals, (3) access to economic resources, and (4) the implications for internal administration. Chapter 4 offers the three hypotheses, based on the analysis of the preceding chapter, about the relative capabilities of executive agencies and private companies to respond to the special demands that siting places on the organizations.

Evidence in support of the hypotheses is presented in two case studies--a public sector siting program (in Chap. 5) and a private sector siting program (in Chap. 6). The public sector case, on nuclear waste disposal, is based on extensive histories and studies of the federal effort, program documentation, and interviews with program officials conducted in 1980 for a previous study. The private sector case, on petrochemical plant siting, is based on extensive interviews with company officials conducted in 1982 supplemented by review of some company files. The cases examine the siting experiences of the two organizations over the period from approximately 1970 to present, the organizational structure and delegation of authority, and the current decision process for anticipating and responding to opposition in the external environment.

The final chapter pulls together the findings of the research and discusses the policy implications for federal organizations responsible for the siting of noxious facilities.

II. FACILITY SITING

This chapter briefly describes the siting process and those elements of siting noxious facilities which place special demands on public and private organizations. Assumptions, based on the demands of the siting process, are then presented regarding the organizational capabilities required to site noxious facilities. Finally, the differences in public and private sector siting requirements are considered.

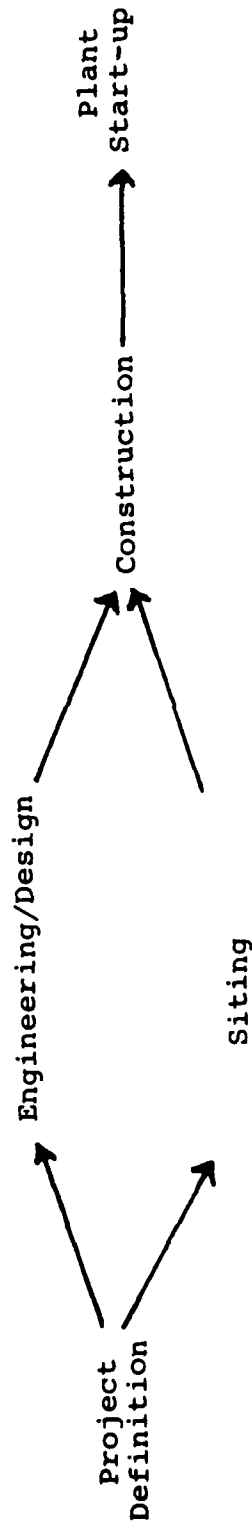
THE SITING PROCESS AND SPECIAL DEMANDS OF IMPLEMENTATION

Siting is one element of facility development or capital construction. Facility development includes the entire set of planning and operational tasks which are required to design, engineer, site, build, and staff a new facility or expansion. Figure 1 illustrates the place of siting within the larger activity. Facility development is usually an integrated function within an organization and, therefore, isolating one element of the activity is artificial. In so doing, one loses some cohesion and perspective of the whole. Nevertheless, separation is necessary for our purposes. For this research, the siting process includes three activities:

1. Project definition
2. Location decision
3. Implementation including (a) obtaining requisite permits and approvals and (b) acquiring land

Figure 1

FACILITY DEVELOPMENT



Different organizations will structure this process differently on several dimensions:

1. degree and nature of internal coordination and communication
2. duration and interrelation of different project phases
3. place within overall organizational structure

Project Definition

The distributions among groups and individuals of costs, benefits, and risks from a facility are largely a function of how the project is defined. Project definition (see Fig. 1) is the first task in facility development. It is not traditionally thought of as part of the siting process, yet it significantly affects the nature and challenge of the siting process. Project definition involves determining the physical, material, operational, and human resources required to meet a recognized need (e.g., for additional capacity) or to take advantage of a new opportunity (e.g., a new production process or consumer product).[1]

Depending upon how it is defined, a project may require a great deal of land or little land and may be built on existing holdings or on holdings not yet acquired. Projects fulfilling similar needs but defined or configured somewhat differently may confer different benefits on the host community in the form of taxes, jobs, and economic growth. They will also impose different costs on the host community in the form of emissions, need for services, and potential hazard. For example, a new facility which relies on existing roadways may impose net costs on a community whereas a facility which provides new or upgrades old roadways may confer a potential benefit on the community.[2] Similarly, a

[1] Some needs are met or opportunities exploited without resort to new capital construction; I am not interested in those cases for purposes of this research.

[2] A firm might routinely plan to improve roads as part of major facility development in order to increase community support and to reduce overall project costs. While building roads will increase the construction costs of the facility, it will also alter the distribution of costs and benefits and might reduce opposition to the facility thus reducing the cost to the firm of advocacy.

facility which disposes of hazardous wastes on-site presents potential long-term risk to the community whereas a facility which ships wastes off-site eliminates the long-term risk but substitutes an increased risk from transportation accidents and spills.

The nature of the project definition activity differs substantially among various chemical process companies (Morrow, 1981).

Some companies have extensive requirements for what constitutes an acceptable project definition exercise and strictly adhere to those requirements. The requirements often include long checklists of items relating to the site, regulatory requirements, preparation of preliminary flow sheets, and so forth. At the opposite extreme are firms that have essentially no project definition stage at all. (Morrow, pp. 8-9)

Location Decision

The location decision process for all industrial plants (including light manufacturing, non-noxious facilities) involves a three-stage spatial decisionmaking process (Petto, 1979). At the first stage, a broad region is identified. Usually, markets (for factors of production and products) and transportation costs are primary considerations at this stage. Alternative communities within the region of interest are identified at the second stage. Labor supply and wage rates (for construction and operation), availability of utilities, energy supplies, and water, and institutional factors such as business climate and tax structure are evaluated during this second stage. The final stage involves selecting a specific site. Site-specific evaluation will consider the physical qualities of given tracts of land and construction and operation costs peculiar to the sites. Thus, the traditional factors evaluated in siting any plant include:[3]

[3] These are the principal factors considered by General Electric

labor availability

transportation of

- raw materials to the plant
- product to the market

taxes/municipal finance

utilities

community services

community environment

individual sites available in the community

Much of the literature focuses on the need for location decisions to minimize production costs. For example, the literature often considers the primary objective as minimizing cost of purchasing and transporting raw materials to the plant site while at the same time limiting processing costs such as wages, rents, interest rates, taxes, and other requirements (Petto, 1979).

Real location decisions, however, involve a balancing of tangible and intangible factors. For example, proximity to important product markets may be important. Also potentially important are the likely actions of competitors. If processing costs are equal, generally the "optimal" location for a firm is where demand for its output is large relative to nearby supply. Another potentially important factor is the rapidity of installing new production capacity. When introducing a new consumer product, being first in the market can often ensure a high market share. In this case, a firm will sacrifice short-term cost

in siting industrial facilities; see Area Development, "How GE Analyzes a New Plant Location," November 1973. See also Cross and Simon, 1975.

savings if a short construction schedule can thereby increase market share and revenues. Limiting development time is also important in limiting construction costs and uncertainty--events (such as interest rates) are much easier to anticipate and prepare for in the short term than in the long term. Finally, maintenance of corporate image might affect location and design decisions. If a firm believes that long-term profitability is enhanced by the establishment and maintenance of a positive corporate image, additional funds might be spent to build a plant in an area or community where the organization's image is already established.

Implementing the Location Decision

While the choice of location is made by the siting organization, it requires the concurrence and approval of groups and individuals outside the organization. Organizations and individuals become involved in location decisions (1) because they have legal responsibility which makes them concerned with the manner of facility development or (2) because their interests (economic, political, legal, and sense of well-being) are affected by the proposed facility. Parties to a location decision often include diverse organizations. State and local governments will become involved as a result of legal responsibilities and pressure from constituencies for protection of the environment and public health and safety. Federal agencies might become involved depending upon land ownership and the distribution of environmental and health and safety protection responsibility. Local citizen groups will become involved depending upon their perception of how the facility will affect their interests. Local groups may be on one or both sides of a siting conflict. Finally, other nonlocal interest groups will become

involved if they perceive that the facility or location will affect their interests. For example, if the facility is proposed for a remote area in order to limit population exposure, national environmental groups may oppose the location in the interests of environmental preservation. Thus, the number of required approvals and difficulty in obtaining them is, in part, a function of the desirability (or lack thereof) of the facility to segments of the population. This makes siting of noxious facilities more difficult than siting of other facilities.

Approval is accomplished when the full range of required permits and land-use approvals have been obtained, land is acquired, and construction begins. A common denominator of the multitude of permits and land-use approvals is that they are generally issued after public concerns are voiced through formal channels of participation such as public hearings. Each approval point provides groups and individuals, whose interests are affected by the proposed facility, a chance to oppose or support the proposal. Opposition (or support) is most often exercised through these legal and procedural channels.[4]

The location decision determines the specific groups and individuals who will incur costs (or receive benefits)[5] of developing the proposed facility. Once a specific location is identified, the magnitude of costs and benefits is also made more certain. While the

[4] Local citizen groups and environmental and other public-interest groups are not restricted to existing legal and procedural channels. Opposition can also be exercised through ad campaigns, boycotts, scrutiny by the press, and other avenues which are designed to create difficulties for a public or private siting organization.

[5] In this section and throughout the report, I am considering locational costs and benefits and not those that accrue to shareholders, suppliers, competitors, and the like.

project definition determines, for example, the total emissions, the location decision determines the specific population and number of people at risk. Similarly, for example, once a location decision is made, the incremental strain on existing roads or the incremental benefit of new roads can be identified with a specific population.

In looking at opposition expressed to noxious facilities by individuals and groups outside the organization, five sources (or areas) of conflict can be identified. Conflict stems from a combination of (a) the specific elements of the proposed facility (e.g., the distribution of costs and benefits to those affected by the facility) and (b) the attitudes of the siting organization and those whose interests are affected. The five sources of conflict fall into two categories according to whether the sources of conflict might be limited by modifying the distribution of costs and benefits (e.g., by changing the project definition) or whether conflict can only be limited by changing the attitudes of the actors. Sources of conflict which might be limited by modifying the distribution of costs and benefits include:

1. equity or distributive issues; and
2. differences in the levels of risk which are acceptable to different populations or groups.

Sources of conflict which can only be limited by changing the attitudes of important actors include:

3. differences in technical judgment;
4. distrust of the siting/developing organization by those whose interests are affected by the proposed facility; and

5. unreconcilable differences in world view between the siting organization and those whose interests are affected.

Equity or distributive issues are a familiar source of conflict and involve the distribution of socioeconomic effects, benefits, risks, and responsibility. The building of roads as a way of providing a service to the community instead of imposing a cost through additional strain on existing roads represents a distributive issue. In another example, some groups will oppose the facility because it would upset their own economic or industrial plans possibly by competing for available labor or natural resources. The above examples involve the distribution of socioeconomic costs and benefits and are likely to occur in the siting of all types of noxious facilities.

In addition to socioeconomic impacts are issues which involve the distribution of risks and responsibility across society. These occur most often in the siting of facilities which present geographically asymmetric distributions of costs and benefits. Examples of such facilities include waste facilities (nuclear or hazardous wastes) and nuclear power plants where a (small) subset of those who benefit from the facilities incur risks. Many communities do not want to be the "dumping ground" for the state or the nation. Similarly, many western communities have expressed opposition to siting of radioactive waste facilities because they are associated with nuclear power plants which are concentrated outside the western states. In this case, the communities do not want to assume the risks of disposal when the benefits of nuclear power generation accrue to others outside the region.

Since distributive issues arise as a result of the distribution of costs and benefits, some potential conflict can be reduced by changing the distribution of costs and benefits to satisfy important actors outside the organization. Some distributive issues can be limited initially through project definition and choice of location. Once a location is chosen, distributive issues can be resolved through side-payments.[6] Side-payments can include indirect payments such as establishment of buffer zones or park areas, rerouting of traffic, design of the transportation networks, guarantee of land values, and redundant safety systems. Or they may entail direct payments such as provision of services (e.g., mortgage lending), cash payments, and deeding land.

Differences in the levels of risk (perceived or actual) and uncertainty which are acceptable to different groups and individuals pose a second potential source of siting conflict. With identical knowledge about risks, one individual will choose to live near a nuclear plant and another will not. This results from different utility functions or value systems. It also is influenced by the reliance by the community on nearby natural resources. For example, a community that has heavy industry as an economic foundation will likely tolerate the risks of air pollution more so than a community which relies on

[6] Side-payments, in this context, involve the legal exchange of goods or services of value (including cash payments) by the siting organization, not required by law, for approval to site or construct a facility. Standard payments in lieu of taxes by a government entity to a host community are a form of side-payment. Similarly, reducing emissions below what is required by law is a form of side-payment. Side-payments can also go the other way. A community desiring a particular facility might forgo certain tax payments or other fees or services to induce a company to site the desired facility in the community.

light manufacturing. Conflict which results from different levels of acceptable risk can be limited during project definition. For example, an organization might identify the lowest level of risk acceptable to a powerful affected group and design safety measures to accommodate that group. The choice of location is also important in that many values are held in common by most or many members of a community. Therefore, the firm can choose to site the facility in a community which has demonstrated a willingness to accept a certain level or kind of risk.

Differences in the acceptable level of risk are, obviously, related to the first source of conflict--distribution of costs and benefits. It is important, though, to distinguish them because the actions which an organization can take to limit the potential for conflict are likely to be different in the two cases. In the first case, if a community does not want to accept the costs of hazardous waste disposal for the region, such opposition might be limited by increasing the economic benefits of the proposed waste disposal facility to make the facility more attractive to the local population. If, on the other hand, the potential host community has a sizable or influential population that is concerned with the potential for groundwater contamination, offering direct or indirect monetary side-payments is less likely to be successful in overcoming such opposition. Changing the design of the facility to include, for example, extra liners to isolate chemicals from the ground or approaching a community which is less dependent upon groundwater might successfully overcome potential opposition in the second case.

Third, conflict results from differences in technical judgment. Uncertainty about the health and environmental effects of chemical

compounds characterizes the technical debate about the desirability of any noxious facility. For example, there is legitimate scientific controversy about the level of any single carcinogen which is safe-- that is, which will produce no ill effects. This is a source of conflict which is unlikely to be resolved during the siting of any specific facility and which must be anticipated and managed.

Differences in technical judgment will most likely pose difficult-to-resolve opposition to facility siting when the proposed facility is a first-of-its-kind, one-of-a-kind, or employs undemonstrated technology. For example, new generation waste disposal (hazardous and low-level nuclear), oil shale, high-level radioactive waste disposal, and recombinant DNA laboratories employ undemonstrated safety systems and have been subject to well-publicized differences in technical judgment.

Distrust of large private and public organizations poses a fourth source of potential conflict. When distrust is present in a segment of the concerned community, interactions with the organization and information disseminated by the organization are suspect. This source of conflict, again, presents a difficult management task for any organization. Ways to establish (or reestablish) credibility are the topic of debate in the policy community (OTA, 1982) and the academic community (Coser, 1956; Mitchell, 1973, Rivkin, 1977). A general consensus seems to be forming that initial distrust can be limited-- or credibility established--through a candid and open decision process and through stable policies and procedures.[7]

[7] Many managers who are involved with programs, such as the federal nuclear waste management program, which have suffered loss of credibility believe that, once lost, credibility is impossible to regain through deliberate efforts. Secondly, many believe that loss of credibility is independent of the decision process but results from an indiscriminant lumping of similar agencies or companies regardless of their individual records. (Observations are based on personal interviews.)

Finally, conflict can arise as a result of unreconcilable differences in values or world view between the siting organization and those whose interests are affected by the proposed facility. For example, some will oppose all new industrial facilities because of a belief in "no growth." Similarly, some will oppose all nuclear facilities because of a belief that the risks of radiation exposure (even very low probabilities of exposure) are unacceptable. While it is difficult to distinguish this source of conflict from the other sources of conflict (because the difference is one of degree and not of kind), it is important to do so. As indicated, some differences in values can be overcome by changing the distribution of costs and benefits but can still result in the construction of a facility. Some differences in levels of acceptable risk can be reconciled by increasing safety systems.[8] On the other hand, some of these differences are unreconcilable--no changes in facility design or use of side-payments will resolve opposition. It is important to distinguish unreconcilable differences in values from other distributive issues or other sources of conflict because they require different handling than conflict which can be resolved by changing the distribution of costs and benefits. Conflict which cannot be resolved must be anticipated, limited from the outset, and managed once it arises.

As suggested by the above discussion, it is important to differentiate between the sources of conflict because different sources can be resolved or limited by different responses. On the other hand,

[8] The increased investment by the organization required to reduce risk to an acceptable level may not be economically justified. In this case, the conflict will not be worth the cost of resolving; but it is reconcilable.

the different sources of conflict are not fully independent of each other. Differences in world view or value structures between the organization proposing a facility and some groups in opposition might also be the source of differences in acceptable risk, distrust of organizations, differences in technical judgment, and differences in objectives regarding the path of community development. But even given a similar overall source, the different sources of conflict have different implications for the siting organization. Differences in acceptable risk might be overcome by adding safety features to the facility. Differences in objectives regarding the path of community development will only be resolved by sufficient community support to overpower opposition. If such conflict is too strong to overcome, the proposal will not succeed. Therefore, not only the source of conflict is important but also the power of the opposing group, their stakes in the conflict, their tactics, and resources. The second through fifth sources of conflict are fairly new to most organizations as constraints on action. They will be difficult or impossible to fully resolve and will require strategies to limit conflict from the outset (through project definition, choice of locale, and an open process) and to anticipate and manage or lessen conflict which is unavoidable.

Two powerful avenues are available through which opposition to a proposed facility can be directed: environmental permit processes and land-use planning and approval processes. Environmental permits are designed to control emissions to the air and potable water (surface and groundwater). In response to improved knowledge about health and environmental hazards and a rising standard of living, concern about public health and environmental degradation has increased. The result

is a complex series of federal and state laws which are designed to protect health and the environment. Many point to 1970 as a "right of passage" for the environmental movement with the enactment of the National Environmental Policy Act (NEPA). There are four important federal statutes which were enacted and are administered separately but together comprise the current framework for environmental control and permitting.[9] These include the Federal Water Pollution Control Act (FWPCA), the Clean Air Act (CAA), the Resource Conservation, Recovery, and Control Act (RCRA), and NEPA. Noxious facilities are required to obtain permits pursuant to the FWPCA and CAA. RCRA sets out (somewhat uncertain and still developing) requirements and procedures for disposal, transport, and storage of hazardous wastes. NEPA requires environmental impact statements (EISs) from federal agencies prior to taking a "major action." These statements must include an assessment of the environmental and socioeconomic consequences of the proposed action and available alternative actions. They must also identify measures to mitigate adverse impacts. Major actions requiring an EIS include, among other activities, actual construction by a government agency, use of federally owned land, and issuance of permit approvals or licenses.

The framework for environmental control is national but is implemented on a state-by-state or locale-by-locale basis. Some states further delegate authority to locales beyond that required by federal law. Most states also impose environmental control requirements or procedures in addition to those of the federal government. For example, most states have state statutes equivalent to NEPA.

[9] The "framework" is in constant flux as new regulations are developed and implemented and as the statutes themselves are amended and interpreted. The system of laws and regulations is among the most complex in the nation.

A multitude of environmental permits and approvals are needed prior to construction and operation of a noxious facility. For example, consider the case of a \$500 million petrochemical complex proposed by Dow Chemical Company for Solano County in northern California during the mid-1970s. The proposed complex would have required 65 permits: five federal, 40 from the State of California, and 20 from three counties.[10] Each of the 65 permits opened an avenue for opponents to express opposition. Dow withdrew its proposal in 1976 after obtaining only four of the 65 permits.[11] The same facility in a different state might have required significantly fewer permits but might also not have been situated such that transportation or material costs permitted cost-effective operations. Table 1 illustrates the diversity in requirements among the 50 states.

In parallel with the rise in environmental control programs, local land-use planning has increasingly discriminated between different types of industries (Cross, 1975 and Kite, 1979). Land-use planning requirements affect siting decision in most states in the form of local zoning or planning regulations and statutes. Land-use is primarily the province of local governments. Many communities have structured local plans to encourage light industry and to discourage heavy industry and noxious facilities (Cross, 1975). Through land-use planning, communities can prohibit or discourage companies and facilities which are not consistent with community values and which threaten to lead the

[10] See Chemical Engineering, "Plant-Siting Barriers Grow," June 20, 1977, p. 70.

[11] The State of California established an office of permit assistance to coordinate the complex permitting process shortly after the Dow incident.

Table 1
WHAT STATES REGULATE
STATES RANKED BY NUMBER OF REGULATIONS
1976

STATE	Requires Environmental Impact Statement	Regulates Land Sales	Reviews and Approves Project Plans	Requires Performance Bonds	Issues Construction Permits	Issues Operating Permits	Requires Public Hearings	Has Enforcement Power	Regulates Indirect Sources of Pollution	TOTAL
1. Hawaii	5	4	6	4	5	5	5	5	4	45
2. Michigan	6	0	6	4	4	5	6	4	4	39
3. Minnesota	6	0	5	4	4	4	4	4	4	35
4. Kentucky*	1	0	6	2	5	5	6	6	3	34
5. Delaware	3	0	5	0	5	5	5	5	5	33
6. Maine	5	0	5	0	3	5	5	5	3	31
7. New York	5	0	4	3	4	4	3	3	1	28
8. New Jersey	3	0	4	4	4	4	2	4	2	27
9. California	4	0	5	0	1	5	4	5	3	27
10. Montana	5	0	5	0	2	1	6	4	2	25
11. Ohio	2	0	5	0	5	5	1	5	2	25
12. Washington	5	0	4	0	2	3	4	4	3	25
13. Mississippi	1	1	4	1	3	4	4	3	3	24
14. Tennessee	0	0	4	0	4	4	4	4	4	24
15. Arkansas	1	0	4	1	3	4	3	4	3	23
16. New Hampshire	2	0	4	0	3	3	5	4	2	23
17. Wisconsin*	4	0	4	0	4	3	2	4	2	23
18. Massachusetts	5	0	4	2	1	1	3	3	3	22
19. Oklahoma	1	0	4	1	4	4	4	4	0	22
20. Nebraska	6	0	4	0	1	5	0	4	2	22
21. Arizona	1	2	4	0	4	3	1	3	3	21
22. Alabama	0	0	4	2	3	4	0	4	3	20
23. Alaska	0	0	3	0	3	4	2	4	4	20
24. Florida	0	0	4	1	4	4	0	4	2	19
25. New Mexico	0	0	4	0	4	4	3	3	1	19
26. Illinois*	0	0	4	0	4	5	0	6	0	19
27. N. Carolina	1	1	2	0	4	4	1	5	1	19
28. Pennsylvania	0	0	4	2	1	4	4	1	1	17
29. Connecticut	0	0	3	0	2	3	3	3	1	15
30. Indiana*	1	0	2	2	3	3	0	3	1	15
31. Louisiana	0	0	3	0	3	5	1	4	1	15
32. Maryland	0	0	4	1	3	2	1	3	1	15
33. S. Carolina	0	0	4	1	2	2	2	4	0	15
34. West Virginia	0	0	3	0	3	3	2	3	1	15
35. Nebraska	0	0	4	0	2	3	0	3	2	14
36. N. Dakota	3	0	3	0	1	3	0	3	1	14
37. S. Dakota	3	0	3	0	3	2	0	3	0	14
38. Texas	2	0	3	0	2	3	1	3	0	14
39. Utah	0	0	4	2	2	0	1	4	3	14
40. Vermont	1	0	3	1	2	1	2	3	1	14
41. Colorado	0	0	3	0	1	2	2	4	1	13
42. Georgia	0	0	3	0	1	3	0	3	3	13
43. Iowa*	0	0	4	0	4	2	0	3	0	13
44. Nevada	0	0	4	0	1	2	0	2	2	11
45. Wyoming	0	0	3	0	2	3	0	3	0	11
46. Rhode Island	0	0	3	0	2	1	0	3	0	9
47. Kansas	0	0	4	1	0	4	0	0	0	9
48. Virginia	0	0	3	0	0	0	2	2	1	8
49. Missouri*	0	0	3	0	1	2	0	0	0	6
50. Idaho	0	0	0	0	1	0	0	3	1	5

* Illinois and surrounding states

Source: A.C. Petto, et al, Environmental Regulations and Other Factors Influencing Industrial Plant Migrations, State of Illinois, Institute of Natural Resources, Chicago, Illinois, 1979, p.11.

community into economic growth patterns which are considered undesirable. Land-use planning has provided as powerful an avenue for opposition as environmental permit processes. For example, a refinery proposed for Durham, Massachusetts in 1973 by Olympic Refining Company was abandoned as a result of opposition channeled through local land-use planning procedures (Deal, 1975).

Another element of siting, not discussed thus far, which places special demands on the organization is the time between siting decisions and the start-up of operations. The siting process itself often takes several years. At a minimum, the preparation of environmental statements, the conduct of permit reviews and hearings, and the issuance of permits take a full year (Cross, 1975). Construction schedules are measured in years because of the complexity of the engineering designs and the logistics of coordinating a massive project. Already lengthy schedules can be delayed by unexpected material supply and labor problems. At the extreme, it takes over 12 years to site, license, and build a nuclear-generating station. Other industrial facilities may take two to eight years for siting, permitting, and construction.

Siting of noxious facilities, then, places special demands on an organization because it is the single element in the facility development process where multiple approvals must come from outside the organization.[12] Formal approval is needed from important governmental (federal, state, and local) actors. The administrative and legal

[12] This is not to say that the corporation does not require external cooperation. If capital is to be borrowed, the project cannot go forward until a lender is secured. Nonetheless, the lender cannot veto the facility; it can simply refuse to lend funds. The corporation then has the opportunity to seek another source of funds.

procedures of these governmental actors also give a strong formal voice to private groups whose interests are affected by facility development. The specific points requiring approval and the sources, forms, and strength of potential opposition will differ from one siting proposal to another. The concern of communities and, therefore, the extent and rigor of controls differ substantially across the country. On its own, the frequency of points where outsiders' decisions are crucial would create difficult problems of coordination. An organization's task is made more difficult because implementation of a siting program will impose costs and confer benefits on these affected groups, and the magnitude and specifics of these potential costs and benefits cannot be fully known in advance. Further, the potential costs include real health, safety, and environmental risks which risks are uncertain and generate considerable emotion and controversy. Conflict must be managed over the entire period of facility development which will, at a minimum, be two years and might be as long as 12.

CAPABILITIES REQUIRED TO SITE NOXIOUS FACILITIES

There are also many factors that influence the sources, forms, and strength of potential opposition to a proposed site which are within the control of the organization. First, the magnitude and nature of costs and benefits can be contained through the project definition exercise.[13] Second, the choice of location influences both the institutional structure of required approvals and the specific groups and individuals who will be affected by the proposed facility. Thus by choosing the locale, the organization partially determines the nature of

[13] The ability of an organization to limit risk to the environment or local population will depend, in part, upon its wealth, cost structure, and the technical requirements of the facility.

specific issues, the strength of opposition, and the number of avenues for opposition. Third, through side-payments, modifications to the project definition, and the character of the organization's decision process, the company can manage or resolve existing conflict.

In order to successfully manipulate these factors, an organization requires the capability to (1) continually monitor its external environment in order to anticipate and assess the specific conflicts (potentially or actually) facing the organization and (2) respond differentially to different sources of conflict (Andrews, 1980; Ansoff, 1976; Burns, 1981). Because conflict in siting often results from different values rather than from differences in information, monitoring and other conflict management activities must be done from the perspective of the outside groups in addition to the perspective of the organization.

The requirements placed on the organization by conflict in the external environment also challenge the traditional distribution of decisionmaking within the organization. Traditionally, the decision that a new facility or product line be pursued is made by senior management and involves the setting of corporate goals and the apportionment of resources to meet those goals (Anthony, 1965; Ansoff, 1969; Thompson, 1967). The goals and objectives are then transformed into operational objectives and actions at the middle-management level. Operational or managing activities involve marshalling of given resources to implement a particular corporate objective (Anthony, 1965). The location and development tasks for non-noxious facilities are traditionally operational in nature and do not require the need to anticipate and respond to the political and cultural aspects of the external environment (Anthony, 1965).

Siting of noxious facilities requires the elimination of much of the traditional distinction. It requires more continuous involvement of senior managers because (1) decisions regarding facility definition and location cannot be unequivocally made because of the difficulty in judging the costs of overcoming or limiting opposition, (2) judgments and commitments made by operating officials on-site must be confirmed and supported by senior management in order to maintain organizational credibility, and (3) incentives facing middle management must be consistent with the need to limit and overcome opposition. If upper management is not involved with the location and implementation decisions (at a minimum by setting forth guidelines for dealing with external conflict), then they almost inevitably will be brought in after unanticipated conflict disturbs development schedules, requires diversion of resources to grapple with the demands of the external environment, or changes the cost outlook in such a way as to upset the cost/benefit decision of building the new plant.

Notwithstanding the need for involvement by senior management, the day-to-day interaction with outside groups properly rests with operating officials (Gladwin and Royston, 1975). First, operating officials are responsible for assessing the economic and technical feasibility of projects and for selecting among alternative operating arrangements. Since potential external opposition influences the "correctness" or consequences of these judgments, it is important that operating officials understand and anticipate potential conflict. For example, modes of transportation and routes, emission levels and control mechanisms, and provision of emergency services are among the factors

within the responsibility of operating officials. These same factors can influence the level and nature of opposition. Manipulation of these factors can help lessen or resolve some of the sources of conflict. Second, when authority to make commitments to those potentially in opposition is delegated to operating officials, they are able to supply up-to-date information, develop a rapport with local leaders, and understand local attitudes and interests. Third, the task of regular interaction with interested groups requires more time and detailed knowledge than is at the ready disposal of upper management.

The challenge for the organization is for upper management to understand the constraints posed by the external environment sufficiently to:

- set corporate goals which place siting decisions in the broader arena of the organization's relationship with environmental preservation, community relations, and societal questions of health and safety;
- develop guidance for operating staff in day-to-day relations and negotiation with affected groups; and
- establish lines of communication laterally and vertically to ensure the consideration of diverse perspectives, ideas, and attitudes.

In other words, a new distribution of authority is needed to assure that siting managers have sufficient incentive, knowledge, and guidance to respond to potential opposition in the external environment.

The potential for cost savings by limiting opposition through project definition and location choice and the costs of overcoming

remaining opposition must become factors in the overall facility development decisions of organizations. Siting and design decisions are traditionally made to optimize economic factors subject to technical and other constraints. Institutional factors have traditionally been limited to consideration of tax structures and other quantifiable factors. This proves to be insufficient in the siting of noxious facilities. Conflict and opposition in the external environment decreases the number of potentially available sites and also raises the costs of getting approvals. The time and cost of obtaining approvals must be assessed and balanced with other siting decision factors.

Finally, organizations must continue monitoring and responding to the external environment over the several years from project definition through start-up of the plant.

DIFFERENCES IN PUBLIC AND PRIVATE SECTOR SITING REQUIREMENTS

Thus far, I have not differentiated public and private sector siting problems or requirements. When the interests of groups outside the organization are adversely affected by a proposed noxious facility, those groups can oppose the siting and development of the facility regardless of whether the siting organization is in the public or private sector. In general, opposition can be expressed through the same channels: environmental permit and land-use[14] reviews and approvals. Similarly, any subset of the five sources of conflict is also independent of which sector is attempting to site the facility.

[14] While many legal observers consider federal authority to be formally sufficient to overcome state and local attempts to exercise such traditional state authority as control of land uses, there is also consensus among these observers that the states retain power sufficient to delay and harass federal attempts at preemption. The expected result is a federal/state impasse (Smith, 1981).

The sources of conflict and strength of opposition are not independent of the nature of the proposed facility. As discussed earlier, concerns about risk depend upon individual value systems. Many individuals are more concerned about the potential risk from ionizing radiation (e.g., potential risks from nuclear reactors and nuclear waste disposal) than from toxic chemical emissions into the air and water (e.g., potential risks from pesticide formulation or petrochemical plants). Differences in technical judgments are more likely to occur with new technologies (e.g., hazardous and nuclear waste disposal) than with established technologies.

A few public and private sector activities are likely to face severe opposition arising from all or most of the five sources of conflict. For example, in the private sector, hazardous waste disposal in the past several years has faced and will probably continue to face intense opposition from diverse sources. Hazardous waste disposal poses equity and distributive issues including distribution of risk and responsibility since hazardous wastes from a wide region are likely to be disposed of in a single location. Issues of acceptable risk are raised because of the permanent nature of the facility and potential for degradation of groundwater which is the water supply for large segments of the population. The safety of hazardous waste disposal is unproven, and differences in technical judgment are aired in the popular literature and in news reporting. Finally some spectacular examples of the potential for risk to health and safety--notably Love Canal in upstate New York--have intensified the emotional response to hazardous waste disposal.

Similarly, in the public sector, nuclear waste disposal generates intense opposition from diverse sources. Like hazardous waste disposal, nuclear waste disposal poses questions of equity, acceptable risk, and technical judgment. In addition, the anti-nuclear movement is established and sophisticated while no such generalized hostility exists toward potential chemical hazards. The changing policy direction and processes of the federal government in its efforts to site a high-level radioactive waste repository have led to distrust of the DOE (and its predecessor agencies) by many whose interests are potentially affected by the federal program including state governments (see Chap. 5). Finally, fewer nuclear repositories are needed than hazardous waste sites. Thus the equity issues, emotional concern, and conflict are concentrated and national in scope for a nuclear repository while often local or regional in scope for hazardous waste disposal.

Most private sector activities involving potentially noxious facilities (hazardous waste being a notable exception) face opposition of a less severe and less diverse nature. For example the siting of a petrochemical complex is likely to raise issues (1) of socioeconomic equity and (2) relating to levels of acceptable risk or different perceptions of risk. It is less likely to raise issues of distribution of risk, technical judgment, or distrust of the siting organization.[15] Moreover, any opposition is likely to be local and less emotional than that exhibited to the siting of hazardous or nuclear waste disposal for the reasons cited above.

[15] Unless the organization is known to the population and has taken actions in the past which were considered illegitimate or unfair.

The choice of high-level nuclear waste disposal for the public sector case and petrochemical facility siting for the private sector case, then, presents analytic difficulties. The two types of facilities while facing similar requirements for environmental permits face quite different levels of opposition. The choice of cases accentuates the problems facing the public sector in siting noxious facilities. While there are many facilities sited and developed routinely by public agencies (e.g., hospitals, prisons, and schools), there is a class of facilities such as high-level radioactive waste repositories and ground basing for the MX missile which face a level of opposition generally more severe than faced by the private sector. This results because of the national imperatives which lead to public sector responsibilities and the often first-of-a-kind or one-of-a-kind nature of the facilities.

Notwithstanding differences in the level of opposition and conflict, the ability to respond to conflict and opposition expressed through environmental permit and land-use reviews and approvals requires the capabilities described in the previous section,[16] namely:

1. to continually monitor the external environment, and changes in or improved information about the environment and to respond differentially to different tactics of opposition (e.g., to differentiate distributional issues from technical judgment from differences in values);

[16] Opposition to private sector facilities such as oil refineries, LNG terminals, and petrochemical complexes has been sufficient to cause abandonment of some projects. Similar projects have succeeded (sometimes in the same location) by other companies. Thus it is reasonable to assume that there is a set of capabilities which allows some firms to anticipate and respond to opposition.

2. to delegate to operating officials day-to-day interaction with external groups (including the authority to negotiate solutions) along with guidance from upper management about the limits of acceptable responses;
3. to balance technical, economic, and institutional factors in location and design decisions; and
4. to establish a stable policy over the entire period of facility development.

Differences in the nature and strength of opposition will affect the ease with which these capabilities are developed and the likelihood of success in limiting and managing or resolving conflict. Thus, the comparisons made in this research are only suggestive.

The research assesses whether differences in the set of organizational constraints and requirements (or institutional environments) facing public and private sector organizations influence their respective capabilities to respond to opposition in the external environment. The next chapter looks in detail at the differences in the institutional environments of public and private sector organizations and resulting organizational behaviors.

compounds characterizes the technical debate about the desirability of any noxious facility. For example, there is legitimate scientific controversy about the level of any single carcinogen which is safe-- that is, which will produce no ill effects. This is a source of conflict which is unlikely to be resolved during the siting of any specific facility and which must be anticipated and managed.

Differences in technical judgment will most likely pose difficult-to-resolve opposition to facility siting when the proposed facility is a first-of-its-kind, one-of-a-kind, or employs undemonstrated technology. For example, new generation waste disposal (hazardous and low-level nuclear), oil shale, high-level radioactive waste disposal, and recombinant DNA laboratories employ undemonstrated safety systems and have been subject to well-publicized differences in technical judgment.

Distrust of large private and public organizations poses a fourth source of potential conflict. When distrust is present in a segment of the concerned community, interactions with the organization and information disseminated by the organization are suspect. This source of conflict, again, presents a difficult management task for any organization. Ways to establish (or reestablish) credibility are the topic of debate in the policy community (OTA, 1982) and the academic community (Coser, 1956; Mitchell, 1973; Rivkin, 1977). A general consensus seems to be forming that initial distrust can be limited-- or credibility established--through a candid and open decision process and through stable policies and procedures.[7]

[7] Many managers who are involved with programs, such as the federal nuclear waste management program, which have suffered loss of credibility believe that, once lost, credibility is impossible to regain through deliberate efforts. Secondly, many believe that loss of credibility is independent of the decision process but results from an indiscriminant lumping of similar agencies or companies regardless of their individual records. (Observations are based on personal interviews.)

Finally, conflict can arise as a result of unreconcilable differences in values or world view between the siting organization and those whose interests are affected by the proposed facility. For example, some will oppose all new industrial facilities because of a belief in "no growth." Similarly, some will oppose all nuclear facilities because of a belief that the risks of radiation exposure (even very low probabilities of exposure) are unacceptable. While it is difficult to distinguish this source of conflict from the other sources of conflict (because the difference is one of degree and not of kind), it is important to do so. As indicated, some differences in values can be overcome by changing the distribution of costs and benefits but can still result in the construction of a facility. Some differences in levels of acceptable risk can be reconciled by increasing safety systems.[8] On the other hand, some of these differences are unreconcilable--no changes in facility design or use of side-payments will resolve opposition. It is important to distinguish unreconcilable differences in values from other distributive issues or other sources of conflict because they require different handling than conflict which can be resolved by changing the distribution of costs and benefits. Conflict which cannot be resolved must be anticipated, limited from the outset, and managed once it arises.

As suggested by the above discussion, it is important to differentiate between the sources of conflict because different sources can be resolved or limited by different responses. On the other hand,

[8] The increased investment by the organization required to reduce risk to an acceptable level may not be economically justified. In this case, the conflict will not be worth the cost of resolving; but it is reconcilable.

the different sources of conflict are not fully independent of each other. Differences in world view or value structures between the organization proposing a facility and some groups in opposition might also be the source of differences in acceptable risk, distrust of organizations, differences in technical judgment, and differences in objectives regarding the path of community development. But even given a similar overall source, the different sources of conflict have different implications for the siting organization. Differences in acceptable risk might be overcome by adding safety features to the facility. Differences in objectives regarding the path of community development will only be resolved by sufficient community support to overpower opposition. If such conflict is too strong to overcome, the proposal will not succeed. Therefore, not only the source of conflict is important but also the power of the opposing group, their stakes in the conflict, their tactics, and resources. The second through fifth sources of conflict are fairly new to most organizations as constraints on action. They will be difficult or impossible to fully resolve and will require strategies to limit conflict from the outset (through project definition, choice of locale, and an open process) and to anticipate and manage or lessen conflict which is unavoidable.

Two powerful avenues are available through which opposition to a proposed facility can be directed: environmental permit processes and land-use planning and approval processes. Environmental permits are designed to control emissions to the air and potable water (surface and groundwater). In response to improved knowledge about health and environmental hazards and a rising standard of living, concern about public health and environmental degradation has increased. The result

is a complex series of federal and state laws which are designed to protect health and the environment. Many point to 1970 as a "right of passage" for the environmental movement with the enactment of the National Environmental Policy Act (NEPA). There are four important federal statutes which were enacted and are administered separately but together comprise the current framework for environmental control and permitting.[9] These include the Federal Water Pollution Control Act (FWPCA), the Clean Air Act (CAA), the Resource Conservation, Recovery, and Control Act (RCRA), and NEPA. Noxious facilities are required to obtain permits pursuant to the FWPCA and CAA. RCRA sets out (somewhat uncertain and still developing) requirements and procedures for disposal, transport, and storage of hazardous wastes. NEPA requires environmental impact statements (EISs) from federal agencies prior to taking a "major action." These statements must include an assessment of the environmental and socioeconomic consequences of the proposed action and available alternative actions. They must also identify measures to mitigate adverse impacts. Major actions requiring an EIS include, among other activities, actual construction by a government agency, use of federally owned land, and issuance of permit approvals or licenses.

The framework for environmental control is national but is implemented on a state-by-state or locale-by-locale basis. Some states further delegate authority to locales beyond that required by federal law. Most states also impose environmental control requirements or procedures in addition to those of the federal government. For example, most states have state statutes equivalent to NEPA.

[9] The "framework" is in constant flux as new regulations are developed and implemented and as the statutes themselves are amended and interpreted. The system of laws and regulations is among the most complex in the nation.

A multitude of environmental permits and approvals are needed prior to construction and operation of a noxious facility. For example, consider the case of a \$500 million petrochemical complex proposed by Dow Chemical Company for Solano County in northern California during the mid-1970s. The proposed complex would have required 65 permits: five federal, 40 from the State of California, and 20 from three counties.[10] Each of the 65 permits opened an avenue for opponents to express opposition. Dow withdrew its proposal in 1976 after obtaining only four of the 65 permits.[11] The same facility in a different state might have required significantly fewer permits but might also not have been situated such that transportation or material costs permitted cost-effective operations. Table 1 illustrates the diversity in requirements among the 50 states.

In parallel with the rise in environmental control programs, local land-use planning has increasingly discriminated between different types of industries (Cross, 1975 and Kite, 1979). Land-use planning requirements affect siting decision in most states in the form of local zoning or planning regulations and statutes. Land-use is primarily the province of local governments. Many communities have structured local plans to encourage light industry and to discourage heavy industry and noxious facilities (Cross, 1975). Through land-use planning, communities can prohibit or discourage companies and facilities which are not consistent with community values and which threaten to lead the

[10] See Chemical Engineering, "Plant-Siting Barriers Grow," June 20, 1977, p. 70.

[11] The State of California established an office of permit assistance to coordinate the complex permitting process shortly after the Dow incident.

Table 1
WHAT STATES REGULATE
STATES RANKED BY NUMBER OF REGULATIONS
1976

STATE	Requires Environmental Impact Statement	Regulates Land Sales	Reviews and Approves Project Plans	Requires Performance Bonds	Issues Construction Permits	Issues Operating Permits	Requires Public Hearings	Has Enforcement Power	Regulates Indirect Sources of Pollution	TOTAL
1. Hawaii	5	4	6	4	5	5	5	5	4	45
2. Michigan	6	0	6	4	4	5	6	4	4	39
3. Minnesota	6	0	5	4	4	4	4	4	4	35
4. Kentucky*	1	0	6	2	5	5	6	6	3	34
5. Delaware	3	0	5	0	5	5	5	5	5	33
6. Maine	5	0	5	0	3	5	5	5	3	31
7. New York	5	0	4	3	4	4	3	3	1	28
8. New Jersey	3	0	4	4	4	4	2	4	2	27
9. California	4	0	5	0	1	5	4	5	3	27
10. Montana	5	0	5	0	2	1	6	4	2	25
11. Ohio	2	0	5	0	5	5	1	5	2	25
12. Washington	5	0	4	0	2	3	4	4	3	25
13. Mississippi	1	1	4	1	3	4	4	3	3	24
14. Tennessee	0	0	4	0	4	4	4	4	4	24
15. Arkansas	1	0	4	1	3	4	3	4	3	23
16. New Hampshire	2	0	4	0	3	3	5	4	2	23
17. Wisconsin*	4	0	4	0	4	3	2	4	2	23
18. Massachusetts	5	0	4	2	1	1	3	3	3	22
19. Oklahoma	1	0	4	1	4	4	4	4	0	22
20. Nebraska	6	0	4	0	1	5	0	4	2	22
21. Arizona	1	2	4	0	4	3	1	3	3	21
22. Alabama	0	0	4	2	3	4	0	4	3	20
23. Alaska	0	0	3	0	3	4	2	4	4	20
24. Florida	0	0	4	1	4	4	0	4	2	19
25. New Mexico	0	0	4	0	4	4	3	3	1	19
26. Illinois*	0	0	4	0	4	5	0	6	0	19
27. N. Carolina	1	1	2	0	4	4	1	5	1	19
28. Pennsylvania	0	0	4	2	1	4	4	1	1	17
29. Connecticut	0	0	3	0	2	3	3	3	1	15
30. Indiana*	1	0	2	2	3	3	0	3	1	15
31. Louisiana	0	0	3	0	3	5	1	4	1	15
32. Maryland	0	0	4	1	3	2	1	3	1	15
33. S. Carolina	0	0	4	1	2	2	2	4	0	15
34. West Virginia	0	0	3	0	3	3	2	3	1	15
35. Nebraska	0	0	4	0	2	3	0	3	2	14
36. N. Dakota	3	0	3	0	1	3	0	3	1	14
37. S. Dakota	3	0	3	0	3	2	0	3	0	14
38. Texas	2	0	3	0	2	3	1	3	0	14
39. Utah	0	0	4	2	2	0	1	4	3	14
40. Vermont	1	0	3	1	2	1	2	3	1	14
41. Colorado	0	0	3	0	1	2	2	4	1	13
42. Georgia	0	0	3	0	1	3	0	3	3	13
43. Iowa*	0	0	4	0	4	2	0	3	0	13
44. Nevada	0	0	4	0	1	2	0	2	2	11
45. Wyoming	0	0	3	0	2	3	0	3	0	11
46. Rhode Island	0	0	3	0	2	1	0	3	0	9
47. Kansas	0	0	4	1	0	4	0	0	0	9
48. Virginia	0	0	3	0	0	0	2	2	1	8
49. Missouri*	0	0	3	0	1	2	0	0	0	6
50. Idaho	0	0	0	0	1	0	0	3	1	5

* Illinois and surrounding states

Source: A.C. Petto, et al, Environmental Regulations and Other Factors Influencing Industrial Plant Migrations, State of Illinois, Institute of Natural Resources, Chicago, Illinois, 1979, p.11.

community into economic growth patterns which are considered undesirable. Land-use planning has provided as powerful an avenue for opposition as environmental permit processes. For example, a refinery proposed for Durham, Massachusetts in 1973 by Olympic Refining Company was abandoned as a result of opposition channeled through local land-use planning procedures (Deal, 1975).

Another element of siting, not discussed thus far, which places special demands on the organization is the time between siting decisions and the start-up of operations. The siting process itself often takes several years. At a minimum, the preparation of environmental statements, the conduct of permit reviews and hearings, and the issuance of permits take a full year (Cross, 1975). Construction schedules are measured in years because of the complexity of the engineering designs and the logistics of coordinating a massive project. Already lengthy schedules can be delayed by unexpected material supply and labor problems. At the extreme, it takes over 12 years to site, license, and build a nuclear-generating station. Other industrial facilities may take two to eight years for siting, permitting, and construction.

Siting of noxious facilities, then, places special demands on an organization because it is the single element in the facility development process where multiple approvals must come from outside the organization.[12] Formal approval is needed from important governmental (federal, state, and local) actors. The administrative and legal

[12] This is not to say that the corporation does not require external cooperation. If capital is to be borrowed, the project cannot go forward until a lender is secured. Nonetheless, the lender cannot veto the facility; it can simply refuse to lend funds. The corporation then has the opportunity to seek another source of funds.

procedures of these governmental actors also give a strong formal voice to private groups whose interests are affected by facility development. The specific points requiring approval and the sources, forms, and strength of potential opposition will differ from one siting proposal to another. The concern of communities and, therefore, the extent and rigor of controls differ substantially across the country. On its own, the frequency of points where outsiders' decisions are crucial would create difficult problems of coordination. An organization's task is made more difficult because implementation of a siting program will impose costs and confer benefits on these affected groups, and the magnitude and specifics of these potential costs and benefits cannot be fully known in advance. Further, the potential costs include real health, safety, and environmental risks which risks are uncertain and generate considerable emotion and controversy. Conflict must be managed over the entire period of facility development which will, at a minimum, be two years and might be as long as 12.

CAPABILITIES REQUIRED TO SITE NOXIOUS FACILITIES

There are also many factors that influence the sources, forms, and strength of potential opposition to a proposed site which are within the control of the organization. First, the magnitude and nature of costs and benefits can be contained through the project definition exercise.[13] Second, the choice of location influences both the institutional structure of required approvals and the specific groups and individuals who will be affected by the proposed facility. Thus by choosing the locale, the organization partially determines the nature of

[13] The ability of an organization to limit risk to the environment or local population will depend, in part, upon its wealth, cost structure, and the technical requirements of the facility.

specific issues, the strength of opposition, and the number of avenues for opposition. Third, through side-payments, modifications to the project definition, and the character of the organization's decision process, the company can manage or resolve existing conflict.

In order to successfully manipulate these factors, an organization requires the capability to (1) continually monitor its external environment in order to anticipate and assess the specific conflicts (potentially or actually) facing the organization and (2) respond differentially to different sources of conflict (Andrews, 1980; Ansoff, 1976; Burns, 1981). Because conflict in siting often results from different values rather than from differences in information, monitoring and other conflict management activities must be done from the perspective of the outside groups in addition to the perspective of the organization.

The requirements placed on the organization by conflict in the external environment also challenge the traditional distribution of decisionmaking within the organization. Traditionally, the decision that a new facility or product line be pursued is made by senior management and involves the setting of corporate goals and the apportionment of resources to meet those goals (Anthony, 1965; Ansoff, 1969; Thompson, 1967). The goals and objectives are then transformed into operational objectives and actions at the middle-management level. Operational or managing activities involve marshalling of given resources to implement a particular corporate objective (Anthony, 1965). The location and development tasks for non-noxious facilities are traditionally operational in nature and do not require the need to anticipate and respond to the political and cultural aspects of the external environment (Anthony, 1965).

Siting of noxious facilities requires the elimination of much of the traditional distinction. It requires more continuous involvement of senior managers because (1) decisions regarding facility definition and location cannot be unequivocally made because of the difficulty in judging the costs of overcoming or limiting opposition, (2) judgments and commitments made by operating officials on-site must be confirmed and supported by senior management in order to maintain organizational credibility, and (3) incentives facing middle management must be consistent with the need to limit and overcome opposition. If upper management is not involved with the location and implementation decisions (at a minimum by setting forth guidelines for dealing with external conflict), then they almost inevitably will be brought in after unanticipated conflict disturbs development schedules, requires diversion of resources to grapple with the demands of the external environment, or changes the cost outlook in such a way as to upset the cost/benefit decision of building the new plant.

Notwithstanding the need for involvement by senior management, the day-to-day interaction with outside groups properly rests with operating officials (Gladwin and Royston, 1975). First, operating officials are responsible for assessing the economic and technical feasibility of projects and for selecting among alternative operating arrangements. Since potential external opposition influences the "correctness" or consequences of these judgments, it is important that operating officials understand and anticipate potential conflict. For example, modes of transportation and routes, emission levels and control mechanisms, and provision of emergency services are among the factors

within the responsibility of operating officials. These same factors can influence the level and nature of opposition. Manipulation of these factors can help lessen or resolve some of the sources of conflict. Second, when authority to make commitments to those potentially in opposition is delegated to operating officials, they are able to supply up-to-date information, develop a rapport with local leaders, and understand local attitudes and interests. Third, the task of regular interaction with interested groups requires more time and detailed knowledge than is at the ready disposal of upper management.

The challenge for the organization is for upper management to understand the constraints posed by the external environment sufficiently to:

- set corporate goals which place siting decisions in the broader arena of the organization's relationship with environmental preservation, community relations, and societal questions of health and safety;
- develop guidance for operating staff in day-to-day relations and negotiation with affected groups; and
- establish lines of communication laterally and vertically to ensure the consideration of diverse perspectives, ideas, and attitudes.

In other words, a new distribution of authority is needed to assure that siting managers have sufficient incentive, knowledge, and guidance to respond to potential opposition in the external environment.

The potential for cost savings by limiting opposition through project definition and location choice and the costs of overcoming

remaining opposition must become factors in the overall facility development decisions of organizations. Siting and design decisions are traditionally made to optimize economic factors subject to technical and other constraints. Institutional factors have traditionally been limited to consideration of tax structures and other quantifiable factors. This proves to be insufficient in the siting of noxious facilities. Conflict and opposition in the external environment decreases the number of potentially available sites and also raises the costs of getting approvals. The time and cost of obtaining approvals must be assessed and balanced with other siting decision factors.

Finally, organizations must continue monitoring and responding to the external environment over the several years from project definition through start-up of the plant.

DIFFERENCES IN PUBLIC AND PRIVATE SECTOR SITING REQUIREMENTS

Thus far, I have not differentiated public and private sector siting problems or requirements. When the interests of groups outside the organization are adversely affected by a proposed noxious facility, those groups can oppose the siting and development of the facility regardless of whether the siting organization is in the public or private sector. In general, opposition can be expressed through the same channels: environmental permit and land-use[14] reviews and approvals. Similarly, any subset of the five sources of conflict is also independent of which sector is attempting to site the facility.

[14] While many legal observers consider federal authority to be formally sufficient to overcome state and local attempts to exercise such traditional state authority as control of land uses, there is also consensus among these observers that the states retain power sufficient to delay and harass federal attempts at preemption. The expected result is a federal/state impasse (Smith, 1981).

The sources of conflict and strength of opposition are not independent of the nature of the proposed facility. As discussed earlier, concerns about risk depend upon individual value systems. Many individuals are more concerned about the potential risk from ionizing radiation (e.g., potential risks from nuclear reactors and nuclear waste disposal) than from toxic chemical emissions into the air and water (e.g., potential risks from pesticide formulation or petrochemical plants). Differences in technical judgments are more likely to occur with new technologies (e.g., hazardous and nuclear waste disposal) than with established technologies.

A few public and private sector activities are likely to face severe opposition arising from all or most of the five sources of conflict. For example, in the private sector, hazardous waste disposal in the past several years has faced and will probably continue to face intense opposition from diverse sources. Hazardous waste disposal poses equity and distributive issues including distribution of risk and responsibility since hazardous wastes from a wide region are likely to be disposed of in a single location. Issues of acceptable risk are raised because of the permanent nature of the facility and potential for degradation of groundwater which is the water supply for large segments of the population. The safety of hazardous waste disposal is unproven, and differences in technical judgment are aired in the popular literature and in news reporting. Finally some spectacular examples of the potential for risk to health and safety--notably Love Canal in upstate New York--have intensified the emotional response to hazardous waste disposal.

Similarly, in the public sector, nuclear waste disposal generates intense opposition from diverse sources. Like hazardous waste disposal, nuclear waste disposal poses questions of equity, acceptable risk, and technical judgment. In addition, the anti-nuclear movement is established and sophisticated while no such generalized hostility exists toward potential chemical hazards. The changing policy direction and processes of the federal government in its efforts to site a high-level radioactive waste repository have led to distrust of the DOE (and its predecessor agencies) by many whose interests are potentially affected by the federal program including state governments (see Chap. 5). Finally, fewer nuclear repositories are needed than hazardous waste sites. Thus the equity issues, emotional concern, and conflict are concentrated and national in scope for a nuclear repository while often local or regional in scope for hazardous waste disposal.

Most private sector activities involving potentially noxious facilities (hazardous waste being a notable exception) face opposition of a less severe and less diverse nature. For example the siting of a petrochemical complex is likely to raise issues (1) of socioeconomic equity and (2) relating to levels of acceptable risk or different perceptions of risk. It is less likely to raise issues of distribution of risk, technical judgment, or distrust of the siting organization.[15] Moreover, any opposition is likely to be local and less emotional than that exhibited to the siting of hazardous or nuclear waste disposal for the reasons cited above.

[15] Unless the organization is known to the population and has taken actions in the past which were considered illegitimate or unfair.

The choice of high-level nuclear waste disposal for the public sector case and petrochemical facility siting for the private sector case, then, presents analytic difficulties. The two types of facilities while facing similar requirements for environmental permits face quite different levels of opposition. The choice of cases accentuates the problems facing the public sector in siting noxious facilities. While there are many facilities sited and developed routinely by public agencies (e.g., hospitals, prisons, and schools), there is a class of facilities such as high-level radioactive waste repositories and ground basing for the MX missile which face a level of opposition generally more severe than faced by the private sector. This results because of the national imperatives which lead to public sector responsibilities and the often first-of-a-kind or one-of-a-kind nature of the facilities.

Notwithstanding differences in the level of opposition and conflict, the ability to respond to conflict and opposition expressed through environmental permit and land-use reviews and approvals requires the capabilities described in the previous section,[16] namely:

1. to continually monitor the external environment, and changes in or improved information about the environment and to respond differentially to different tactics of opposition (e.g., to differentiate distributional issues from technical judgment from differences in values);

[16] Opposition to private sector facilities such as oil refineries, LNG terminals, and petrochemical complexes has been sufficient to cause abandonment of some projects. Similar projects have succeeded (sometimes in the same location) by other companies. Thus it is reasonable to assume that there is a set of capabilities which allows some firms to anticipate and respond to opposition.

2. to delegate to operating officials day-to-day interaction with external groups (including the authority to negotiate solutions) along with guidance from upper management about the limits of acceptable responses;
3. to balance technical, economic, and institutional factors in location and design decisions; and
4. to establish a stable policy over the entire period of facility development.

Differences in the nature and strength of opposition will affect the ease with which these capabilities are developed and the likelihood of success in limiting and managing or resolving conflict. Thus, the comparisons made in this research are only suggestive.

The research assesses whether differences in the set of organizational constraints and requirements (or institutional environments) facing public and private sector organizations influence their respective capabilities to respond to opposition in the external environment. The next chapter looks in detail at the differences in the institutional environments of public and private sector organizations and resulting organizational behaviors.

Effect of Popular Elections

A further point to be made about external political control over agencies is the potentially disruptive effect of their relatively rapid turnover in top personnel compared with that in private industry (Waldo, 1955; Banfield, 1975; Buchanan, 1975).[24] Changes in federal policy over the past 15 years regarding nuclear waste management provide an excellent example. In the late 1960s, waste management was considered a minor operating responsibility of the waste generator. In 1970, after public intervention, the Atomic Energy Commission (AEC) assumed responsibility for disposal of all high-level nuclear wastes. At the beginning of the 1970s, the AEC was confident that repositories could be sited and constructed in bedded salt with relative ease. The early AEC program was a development and demonstration program. Demonstration was to take place in Lyons, Kansas. National-level opposition to the program as well as sophisticated local opposition arose. The Lyons project was canceled in 1972 at the direction of the White House during President Nixon's (successful) bid for reelection. Under the direction of James Schlesinger (a political appointee of President Nixon), by late 1972, programs for developing bedded salt repositories gave way to a program for interim surface storage of wastes. Strong opposition to the

[24] Somewhat analogous to the effects of popular elections on public sector management are the effects of mergers, takeovers, and other rapid changes of management in private firms. The analogy is incomplete because such rapid changes in management in the private sector are often in response to the performance of a private company (e.g., stockholder revolts) and they are unscheduled. On the other hand, public elections are scheduled (congressional elections every two years and presidential elections every four). This schedule is not related to the lifetime of federal programs and influences the incentives built into the management of federal executive agencies (see rest of discussion in this section).

storage program developed within the federal government itself when the EPA failed to approve the required environmental impact statement. Surface storage, as a solution, was abandoned in 1974 in favor, once again, of bedded salt repositories. During the 1976 election campaign, candidate Carter stated his intent to make commercial reprocessing of spent nuclear fuel illegal in order to curtail proliferation of nuclear materials (primarily plutonium). In 1977 President Carter kept his promise. Thus, the federal program was redirected from research and development on disposal of reprocessed waste to disposal of spent fuel. President Reagan's administration has returned to encouraging commercial reprocessing and specified that only reprocessed waste should be disposed of. This has potentially set back the technical portions of the federal program by several years. It should be noted that the decisions recounted briefly above were based primarily on political considerations and occurred during transitions of political power.[25]

The behavioral impacts of frequent changes in administration go beyond policy redirections. Management succession and the results' time-horizon are also affected. In discussing differences in government and business, James Dimling (treasurer, Marathon Oil, formerly with HEW) comments:

When there is a change in administration or a blowup such as Watergate, policy-making posts sometimes remain unfilled for several months. I have never come in contact with such discontinuities in industry. Positions of that stature, and of that authority and responsibility, are filled immediately. There is a management succession that is constantly ready to move, and one can usually identify the likely successors for a particular position.[26]

[25] See Chap. 5 for a more detailed description of the DOE waste disposal program and changes in its policy direction.

Similarly the disruptions surrounding the firing of Carter officials and slow appointment of replacements was frequently front-page news during the first several months of the Reagan Administration.

A third implication of the relatively short tenure of high-level public officials is strong pressure to produce tangible results during relatively short terms of office. Both Gawthrop (1969) and Wolf (1981) suggest that the rate of time discount of public officials is higher than that of private officials. That is, the extent to which public officials may discount the present for future gains is limited because of their short tenure and need to demonstrate results prior to election day.[27] The ability of private officials to invest for future return is not unlimited, but it is an important ingredient for growth. Examples of private sector investment in programs with long lead times are abundant.[28] One is the oil port and pipeline proposed by the Northern Tier Pipeline Company, a consortium of private companies, for Puget Sound, Washington. The project is now over six years old and is projected to cost \$2.7 billion.[29]

[26] Harvard Business Review, July/August 1974, "Why Business and Government Exchange Executives," p. 133.

[27] It is ironic that some responsibilities, i.e., disposal of high-level radioactive wastes, are assumed by the federal government because of their long-term hazard and the belief that protection of future generations must rest with the public officials.

[28] Examples of public sector projects with long lead times are also abundant, i.e., dams and other "pork barrel" projects. Notice that in such cases, the expenditure of funds in a district is the desired political objective in addition to (and sometimes instead of) completion of the facility itself).

[29] It was rejected by Governor John Spellman in April 1982. The future of the project is uncertain.

NATURE AND CLARITY OF GOALS

It is widely argued in the literature that the nature and clarity of goals differs between the two sectors along three dimensions:[30] (1) greater multiplicity and diversity of objectives and evaluation criteria in the public sector, (2) greater vagueness and intangibility of objectives in the public sector, and (3) greater tendency of goals to be conflicting necessitating more trade-offs among goals in the public sector. The important point of this section for siting of noxious facilities is that the nature and clarity of goals between the two sectors differ primarily because the various interested constituency groups can utilize oversight and control mechanisms to evaluate the performance of federal officials against particular (and singular) goals which are of interest to them. This makes the balancing of objectives especially difficult in the public sector.[31] Competing goals can be treated as constraints on profitability within the private firm and thus be balanced away from the direct scrutiny of the public and interested groups. Notwithstanding the similarity of the intended outcomes (i.e., an operating facility), siting and development of noxious facilities, as analyzed in the cases presented in Chaps. 5 and 6, confirm these observations.

[30] Rainey (1976) suggests that differences in the nature of goals and performance measures is the most frequently cited distinction between public and private organizations. Also see Waldo (1955), Gawthrop (1969), Golembiewski (1969), Wamsley (1973), Banfield (1975), Seidman (1975), and Wolf (1979).

[31] It is the need for balancing noncommensurable goals that leads some functions to be considered public rather than private responsibilities (see political economy literature; e.g., Buchanan, 1962 and Wildavsky, 1964).

A perceived opportunity or need initiates a private firm's consideration to expand an existing chemical processing facility or to build a new one. By opportunity, I mean the opportunity to invest capital in a new venture, product line, or additional capacity; which investment is expected to yield a return that is at least as great or greater than any alternative use of the capital. A new facility or expansion might also result from the recognition that additional capacity is required to maintain a competitive position or to achieve strategic goals. In both cases, economic return on investment is the primary motive.

Once an opportunity or need is recognized, the firm will perform a variety of economic and technical analyses to ascertain anticipated return on investment. As described in Chap. 2, the location decision balances availability of utilities, labor supply, tax structure, and environmental and political feasibility as constraints on an economic optimization (see Chap. 2).[32] If the constrained optimization results in an investment which is more attractive than other opportunities, the project will proceed.[33] In the absence of an adequate return, an

[32] In the case of political and environmental feasibility, an assessment is made regarding the likelihood that all necessary formal and informal approvals will be obtained and of the costs (in time and resources) those approvals might require (see Chap. 2 for a more complete discussion). Admittedly, the techniques for estimating transaction costs are much more poorly developed than the techniques for estimating other development and operating costs. See illustrative case (Chap. 6) for a description of the learning process.

[33] Many companies, including the firm described in Chap. 6, develop lists of projects according to return on investment or similar ranking. They go down the list in order, investing in as many projects as they have or wish to make capital available for. If the ranking of an active project becomes less attractive than for an inactive opportunity, one project might be discontinued in favor of the other. Similarly, if the available capital is decreased, an active project might be abandoned.

investment will not be made.[34]

Thus, the industrial decisionmaker thinks primarily in terms of operating effectiveness and efficiency. Proficiency and sophistication in monitoring and measuring revenues, costs, and profitability provide understandable guidelines to evaluate project performance. As a result, the course of the program can be adjusted or terminated in order to maintain a favorable return on corporate investment. Moreover, top-level executive officials in private corporations are in a relatively secure position to obtain from employees reasonably accurate answers to the important questions of economic and operational feasibility before a particular decision is made.[35] This results because the same measures available to evaluate project performance are available for evaluating employee performance. Thus, organizational incentives can be provided to ensure employee behavior which furthers profitability. Sanctions (e.g., firing nonperforming employees) are available to reinforce the organizational incentives.

In brief, then, the profit motive is the primary goal in private decisions to site and develop a new facility.[36] Competition in the

[34] Returns are not always evaluated strictly on short-run monetary return. Long-run considerations and corporate objectives (e.g., entering new markets) are also considered. Note that even investment in "nonproductive" pollution control equipment and facilities is contained in the "need" category since such investments are considered necessary to maintain existing operations. If complying with regulations results in long-run operating losses, then the activity will be abandoned.

[35] Cost estimates for pilot plants or other one-of-a-kind facilities are notably less accurate than cost estimates for facilities employing known technologies (Morrow, 1981).

[36] Profits should be thought of in a broad, long-term context. Decisions are not necessarily made to maximize short-run profits.

marketplace provides a yardstick to measure performance and an automatic punitive signal of declining profits should objectives not be met. Other considerations (often stated as corporate goals) such as maintaining community relations, health and safety performance, and high employee morale are often secondary goals. Operationally they are treated as constraints rather than goals; the final yardstick is return on investment considering all costs of development including construction and development costs and the costs of obtaining environmental and other approvals.

In contrast, federal decisions to develop controversial noxious facilities are often made to protect public health and safety or to promote national defense--public interests which generate considerable emotion and are considered too important to entrust to private decisions.[37] They are not based on profit objectives or other easily evaluated objectives. Instead, one of the primary goals in building a nuclear waste repository is considered to be protection of public health and safety. This is a public goal which by its nature involves balancing noncommensurable conceptions of public protection. Thus, controversies over how safe is safe enough and on society's ability to evaluate safety continue unresolved and defy a generally accepted standard of measurement.

In addition to protection of health and safety, and as a result of access by multiple constituency groups to multiple decisionmakers,

[37] I will continue in the chapter and throughout the rest of the report to discuss a small subset of federal decisions--the siting of controversial noxious facilities--which may not be representative of other federal decisions. (See previous chapter for discussion of the nature of the nuclear controversy.)

competing goals have surfaced: The nuclear industry has lobbied Congress and the DOE for timely disposal to assure continued nuclear power generation. The same interests have lobbied for federal facilities for away-from-reactor storage of spent fuel. The Carter Administration, in response to considerable pressure from those within the government concerned with international issues, pushed for disposal of spent fuel rather than reprocessed waste to discourage proliferation of weapons-grade nuclear materials (notably plutonium). Environmental groups have lobbied for strict environmental and emission control standards. States have lobbied for veto over proposed sites or other substantial decisionmaking authority.

Many of the goals and objectives considered in the federal waste disposal program must be balanced against each other. For example, cost considerations suggest that a single repository could dispose of waste efficiently well into the twenty-first century. Competing objectives of retrievability of disposed wastes and of geographic distribution of risks argue for multiple repositories. The potential for needed capacity to store spent fuel and the desire (political) to demonstrate safe disposal in the near future argue for a repository in the late 1980s or early 1990s. In opposition to this position, the state of knowledge about hydrogeology and transport of nuclides through various media suggests the development of pilot or test facilities prior to a full-scale facility.

The various interested constituency groups can utilize oversight and control mechanisms (see section on accountability, above) to evaluate the performance of the federal officials against the particular goals which are of interest to themselves. Many goals, such as

protection of health and safety and an "equitable" distribution of responsibilities, benefits, and costs, must be evaluated explicitly in publicly available agency decision documents. The impacts of preferred options must also be compared with the impacts of rejected alternatives. Therefore, federal officials are not able to treat competing goals as constraints. It is in this regard that private and public sector activities diverge. Certainly private companies have competing objectives (e.g., low development costs vs. speed of development and low operating costs vs. environmental protection). Whereas, private firms can treat competing goals as constraints using (short-run or long-run) return on investment as a final measure of acceptability, federal executive agencies must respond to the separate demands of competing interest groups.

A stable national solution (e.g., an agreed-upon site and facility to dispose of nuclear wastes) is extremely difficult to achieve because of the presence of multiple and noncommensurate goals combined with the access of constituency groups to decisionmakers. Important bargaining agents are outside the organization; any coalition or compromise is difficult to maintain because of multiple avenues of access to political decisionmakers; and the siting organization has little control over the place(s) in the process where bargaining or access can occur. In light of the difficulty in agreeing upon the nature of a solution, issues of political effectiveness and feasibility (which depend largely on distributive consequences) have, for the most part, dominated the attention of high-level government decisionmakers (Gawthrop, 1969 and Neustadt, 1960). The description of the major redirections of the federal waste program during election years highlights the dominance of

political expediency over economic and technical effectiveness (see subsection on the effects of popular elections). In contrast, private developers can agree upon the desired objective--profitability--and can control to a greater extent the nature and timing of needed bargaining with outside actors. This places the private firm in a better position to concentrate on issues of economic and operational efficiency.

The effect of differences in the nature and clarity of goals between the public and private sectors is illustrated in the following quotations taken from a conversation among executives who had participated in an executive exchange between business and government organizations:[38]

The government process is much more circuitous. There are more trade-offs to be examined, more compromises to be made.
(James Dimling)

In government, it isn't just that public opinion is hanging over your head. Most decisions there are very, very complicated in terms of whom they affect--what groups in the country, for instance--and the ways those people are affected. And so you have to trade off many more factors to arrive at what might be considered a correct decision.... The criteria for a correct decision [in the private sector] are usually ... much more straightforward and obvious. (David Sternlight)

In business, you tend to view a problem from a single perspective.... My government experience has ... heightened my awareness of the multidimensional aspects of each problem so that I think it out far more keenly than before and try to be more astute about weighing the factors that bear on it. I have seen how necessary it is to look at a spectrum of attitudes before creating government policy. (David Lehman)

[38] Harvard Business Review, July/August 1974, pp. 129-140, "Why Business and Government Exchange Executives."

ACCESS TO ECONOMIC RESOURCES

Private firms and executive agencies possess very different mechanisms for obtaining economic resources. The revenues of corporations are obtained from prices charged for goods or services sold to buyers and from return on investments in capital markets. Buyers can choose what to buy as well as whether to buy. The competitive marketplace provides mechanisms to communicate the desires of buyers. Firms which provide desired goods and services at competitive prices will have higher sales revenues than competing firms. Available capital funds will be a function of revenue, costs, and investment and borrowing decisions.

In contrast, funds are generally authorized and appropriated by Congress on an annual basis to executive agencies.[39] In addition to budget allocations, when services (such as regulatory review or disposal of radioactive wastes) are provided to the private sector, user fees are sometimes charged to cover the cost of providing the service. Even when fees are charged, no market exists where buyers are free to choose not to buy or to choose the quality or nature of the service. Rather, the only choice is not to engage in the activity to be regulated or which will generate certain by-products.

Past sections have described portions of the capital construction decisionmaking processes in both the public and private sectors. This section will track, at a high level of generalization, the access to and decision to commit funds for new construction in the two sectors.

[39] Public corporations, such as the Tennessee Valley Authority, are not executive agencies. TVA operates in a manner similar to private firms. Other federal entities such as the Post Office also deviate from the model of yearly authorizations and appropriations.

Generally, private firms decide first how much they care to invest in new construction and then look for what to spend it on. They are dealing on the margin since most revenues are used to maintain ongoing operations. Public agencies generally go through the opposite decisionmaking process. First they determine what construction they must undertake according to law, then develop a budget request to Congress. The implications of these differences will be explored.

Once a general level of funding for capital construction is established within a firm, a decision to commit capital tends to follow a standard decisionmaking process.[40] The first step is to recognize a need (e.g., for additional capacity) or opportunity to increase profits by investing in a new venture, product line, or additional capacity.[41] Economic return on investment is the primary motive to commit capital funds.[42] The impetus might come from any number of organizational units and might be business center driven or technology driven. An economic evaluation is performed to estimate the costs of construction and operation and to estimate the revenue stream. If the activity cannot pay for itself, it is considered infeasible and will be abandoned or reformulated in major ways (unless a loss is considered necessary for

[40] While I will argue that most private firms follow the same general process, the specific details and organization will differ among firms (Bower, 1972; Andrews, 1980).

[41] Corporate culture, the personal values of officers and directors, or corporate knowledge will affect investment decisions. For example, TOSCO has had a decade-long commitment to synthetic fuels. Thus, while it is likely that the Colony Shale joint venture with Exxon (recently abandoned) looked more economically attractive than alternative synthetic fuel projects, it is also likely that nonsynfuel alternatives received less serious consideration.

[42] Projects can be financed internally (available assets) or externally (borrowing). Cost of capital places a floor on the acceptable rate of return.

achieving a longer-term goal). A more detailed evaluation might then be done on projects which are attractive. This evaluation will take into account potential contingencies, technical considerations, and political and environmental feasibility. The return on investment is estimated if the project remains feasible.

Ventures are first ranked according to estimated return on a divisional level and then across the corporation (if a multidivision corporation). Generally, top-ranked projects are funded until available capital is exhausted.[43] The anticipated return on investment is reevaluated periodically and the corporate decisions to undertake new ventures are reevaluated as the anticipated returns change and as available capital changes.[44]

The process of identifying a needed facility and obtaining funds is radically different for an executive agency. Recognition of a public need is the first step. The impetus is not economic opportunity but involves a function of government such as protection of public health and safety (e.g., a nuclear waste repository) or national defense (e.g.,

[43] Organizational factors such as balance among product lines or divisions of differing organizational capabilities may also be included in the ranking criteria. Projects requiring extremely large investments often require approval from the board of directors.

[44] Conceptually sunk costs are not considered in committing future resources; that is, if a project becomes economically infeasible (that is, it will lose money) future capital will be diverted to other uses to prevent or limit such losses. In practice, organizational factors such as morale considerations and switching costs probably lead to some consideration of sunk costs in future investment decisions (see Wolf, 1973). Notwithstanding some deviation from theoretical decisionmaking, private firms will abandon partial investments which are no longer economically attractive. Examples of abandoned projects include numerous partially constructed nuclear power plants across the country and canceled petrochemical processing plants and oil refineries. In some cases, several hundreds of millions of dollars were spent in planning and applying for needed permits (e.g., the canceled Exxon/TOSCO Colony Shale venture).

defense laboratories or weapons manufacturing and basing facilities). The need can be identified by any number of potential actors including either House of the Congress, the White House, an executive agency, or a public or private interest group. If the decision is initiated in Congress, authorizing legislation or an amendment to the agency's charter conveys the responsibility to establish the facility. The details of the facility may be contained in the legislation or (explicitly or implicitly) in subsequent budget requests and appropriations. When the decision is initiated by the agency or the Administration, frequently the details first appear in budget requests.

Given a recognized need (legislative and executive) for a new facility, funds are usually allocated for a 12-month cycle;[45] the federal fiscal year runs from October 1 through September 30. An agency's budget cycle might be as long as three years depending upon the organization and decentralization of the agency. In preparing the budget request, the first step is to determine the appropriate design of the facility and to estimate the required costs. In the case of most federal facilities, such activity is considered a "major federal action," and the decision about appropriate design must be accompanied by an environmental impact statement.[46] The cost estimate is submitted often as a separate line item in the budget request sent to OMB.

[45] Remember that I have restricted this discussion to executive agencies and on-budget appropriations. Public corporations such as the Tennessee Valley Authority and the Synthetic Fuels Corporation receive funds through charges and other off-budget mechanisms. These funds and the public corporation activities are subject to different oversight mechanisms.

[46] The content of and requirements for public comment on this statement are described in the section on accountability.

The agency is now in the position of advocating the facility--advocating (1) the need for the facility (over potential alternatives), (2) the appropriate configuration, location, and so on, and (3) appropriation of the total estimated costs. The result is a request for funding of a specific proposed facility. The OMB, which assigns examiners to specific agencies and sometimes to specific functions within a single large agency, reconciles the agency request with the overall Administration's goals and budget. Recognizing that the agency is playing the role of advocate, the OMB usually plays the role of skeptic and watchdog (Wildavsky, 1964). Rarely does the OMB increase an agency budget request. Sometimes, it will realign priorities by shifting funds. More often, it cuts agency budget requests (Wildavsky, 1964; Burkhead, 1971). The President's budget is then sent to Congress approximately nine months prior to the beginning of the fiscal year. It is not uncommon for the merits of such facilities to be debated in Congress in the course of budget hearings. The scope and direction of yet-unbuilt facilities are often challenged by both winners and losers, while the continuation of facilities in progress is supported by potential winners. Capital spending for projects is usually authorized piecemeal and is subject to challenge from outside the agency every year.

The difference in the nature of access to resources carries with it significant implications for organizational behavior. The remainder of this section summarizes differences between the sectors with respect to four types of behavior: (1) flexibility to reallocate funds; (2) terminating activities; (3) roles and strategies of line organizations

in obtaining funds; and (4) the timing of reviews, stability of commitments, and planning time-horizons.

Differences in flexibility to reallocate funds are substantial between the two sectors. A private firm is relatively free, at any time, to divert funds from one use to another, subject, of course, to contract and other legal obligations.[47] This freedom results from a bottom line (profitability) against which to rank competing uses of funds, the control of funds within the organization rather than outside of the organization, and extremely limited access by external groups to allocational decisions. congressional authorization and appropriation of funds by line-item within the public sector and legal constraints placed on the agency's freedom to reallocate monies severely limit the ability of an executive agency to divert funds from one use to another--even within the same functional area. For example, by law the NRC cannot reallocate more than 10 percent of program funds without congressional approval.

In a closely related point, public agencies (or the Administration or Congress) are limited in their ability to terminate projects underway (Wolf, 1979; Drucker, 1973; Kaufman, 1971). There are several reasons for this: First, the presence of incommensurate and intangible or vague goals makes it equally difficult to establish priorities or choose among activities in progress. Second, the inflexibility to reallocate funds means that agency programs and staffs cannot be redirected. Third, once underway, those individuals and groups who stand to gain from the continuation of a project will fight to keep it alive. Examples of this political reality can be seen in the fights within Congress for

[47] Internal organizational authority or hierarchy may restrict the freedom to allocate funds in a private organization.

continued funding for the Clinch River Breeder Reactor and the Tennessee-Tombigbee Dam (both in Tennessee) even in light of strong technical and economic evidence against continuing either project. Bureaucratic units within the responsible agencies also continue to advocate projects long after abundant evidence points to redirecting funds and effort. While the same phenomenon occurs in private firms, civil servants can cultivate and encourage political support for the project through access to political officials, Congress, and interest groups. Finally, sunk costs can be more easily used to support continued funding in the public sector than in the private sector. Markets for goods and capital provide automatic sanctions against poor investment decisions thus penalizing a private firm if it continues to fund poor investments. No such punitive device or automatic measures are available for public capital investments. Debates in Congress or within an agency frequently will use the magnitude of sunk costs in support for continued funding of a project. For example, advocates argued successfully before the Senate that it would be foolish to abandon a \$3 billion dollar investment in the MX missile.[48]

The roles and strategies of the private sector and public sector "line" officials are also somewhat different as a result of means of access to resources. In the private sector, performance tends to be judged according to profitability (whether short-run or long-run); thus line officials will generally advocate a project for which they are confident of an adequate return on investment. Public officials, by the nature of the budget system, are in a position of advocating a project because it will fulfill one or more sets of public objectives, which

[48] Los Angeles Times, May 14, 1982, p. 2.

objectives often defy a common metric. They must "sell" the facility, as defined by the internal political/bargaining process, in order to gain funding. It is likely that their performance will be evaluated, at least implicitly, on how well they sell the project to OMB and to Congress. Moreover, they have an incentive to underestimate costs in order to gain initial approval with confidence that they will not be penalized for the error later (Drucker, 1973). Put another way, the *raison d'etre* of the private manager is to increase or maintain profitability. The *raison d'etre* of the public manager is to build a specific facility because it will be beneficial to the public. Building the facility, then, is often substituted as the public official's objective displacing the original objective, e.g., protection of public health and safety. When this happens, the role of the public manager is to advocate the facility for the facility's sake. This substitution of objectives makes it even more difficult for new information about costs and alternatives to be balanced against the original objective, such as occurs when new information is balanced against the private firm's profit motive.

Finally, the regular 12-month review cycle (based on annual authorizations and appropriations), combined with the multiple avenues for interested groups to gain access to policy decisionmaking, often results in frequent policy redirections in controversial areas such as nuclear waste management. The annual review is exercised as a means of oversight of federal funds and allows Congress an opportunity to preview projected budget requests and to review the previous year's operating performance.[49] Thus, on at least 12-month cycles the manager of a

[49] In noncontroversial areas, the entire process works to prevent abrupt departures from previous policies and levels of funding (Gawthrop, 1969 and Wildavsky, 1964).

controversial program must react to potential policy redirections. The need for frequent program changes in response to policy redirections and heightened uncertainty will often result in short planning horizons. A manager will be reluctant to do meaningful long-term planning for programs which experience tells him will be redirected. Moreover, 12-month milestones are often artificial in the life of any capital construction project. A private firm, on the other hand, is free to set up a review process with milestones or checkpoints (go/no go) derived from the logic of the project itself and not from a calendar 12-month criterion.

IMPLICATIONS FOR INTERNAL ADMINISTRATION

Thus far, this chapter has been organized primarily to examine differences in the external environments of private sector and public sector siting organizations and interactions between the organization and its environment. Differences in accountability and control from outside the organization, nature and clarity of goals, and access to resources result in differences in the internal administration of private and public organizations. Previous sections have already discussed some of the ways in which the external environment creates different organizational behaviors and incentives in the public and private sectors. For example, the two sectors exhibit different behaviors with respect to gathering information about the environment, flexibility to reallocate funds, and substitution of activity proxies for original objectives. This section will discuss remaining internal differences important to the siting task--particularly differences in authority relationships and procedures and practices. It is important

to note that internal differences are differences of degree (as opposed to differences of kind) much more so than the factors discussed previously. While it is possible to find private organizations which exhibit internal characteristics quite similar to characteristics displayed by public organizations, in general, there are greater differences between the sectors than within the sectors.

Authority Relationships

Authority relationships in the federal government have been described as having two major characteristics which differ from the private sector. First, high-ranking federal officials (from the President down) are thought to have less control over subordinates and tasks than their counterparts in the private sector. Officers of a private company generally have clear measures of project and employee performance and credible sanctions to discipline nonperformance (authority to dismiss an employee).[50] In the public sector, performance is more difficult to measure[51] and sanctions are unavailable or more difficult and costly (in time and effort) to apply.[52] Furthermore, it is easier in the public sector than the

[50] It is clear that this authority is often not used or orders may not be issued if it is clear that there is significant dissent in the organization. That is, bargaining and compromise are practiced within a private company (to lesser and greater degrees) as a way of assuring mutual goals and progress toward those goals. But the implicit authority of dismissal or denial of advancement and threat to use such authority are present and affect the course of bargaining behavior.

[51] Employee performance is difficult to measure because of multiple vague or noncommensurable goals and the inability to establish common and acceptable metrics of performance.

[52] The Senior Executive Service, part of the Civil Service Reform Act of 1978, contains provisions to make top levels of the bureaucracy answerable to their political superiors. One of the measures is designed to make transfer of members of the Senior Executive Service among agencies relatively easy. The effectiveness of the reforms is still being evaluated; the General Accounting Office (GAO) is scheduled to report to Congress in 1984. In a preliminary evaluation (responsive to an inquiry by Representative Patricia Schroeder), Clifford Gould,

private sector for a subordinate to indirectly fail to comply with a directive by employing multiple appeal and access routes to political superiors, Congress, and interest groups.

For example, during the period from approximately 1975 through 1978, the manager of nuclear waste management licensing activities at the Nuclear Regulatory Commission routinely employed access routes to political superiors, Congress, and interest groups (notably state government officials). He initiated direct conversations with the Commissioners and their assistants in order to persuade them of the correctness of an expanded and activist agency course with regard to licensing of DOE and commercial waste facilities. The actions he advocated (e.g., the scope of proposed regulations) were sometimes different from those of his immediate superior. He devoted personal time and assigned staff to work with congressional committee staffs in drafting proposed legislation. The resulting legislation sometimes differed from the policies officially advocated by the NRC. He also worked with committee staffs in preparing questions to be asked of his political superiors during congressional hearings. "Planting" of questions was a device to force the Commissioners to consider a revised policy position.[53]

Director, GAO, stated that based on a sample of six agencies there were no involuntary reassignments of SES members within the first 120 days after the appointment of their respective agency heads (letter to Schroeder from Gould dated March 23, 1982). This figure may be misleading because the delay in filing sub-Cabinet-level posts (i.e., assistant secretary level position) may also have delayed involuntary SES transfers).

[53] Based on personal experience on the NRC waste management staff during the period of interest.

Second, executive agencies are more likely than private companies to have patterns of delegation that centralize authority in the top levels of the agency and minimize authority available to subordinates including career civil servants (Golembiewski, 1969; Wolf, 1979). One of the results of such patterns is a layering of multiple levels of review. Centralized patterns of delegation of authority result largely from the short tenure of presidential appointees and from their political mandate. Political appointees are generally unable to develop confidence relationships with the career civil service because of short tenure (Golembiewski, 1969). But these appointed officials are held accountable by Congress and by the Administration. Especially important to the political actors is the distributive effects (real and perceived) of policies. We have already seen that distributive and value issues are major sources of conflict external to the agency (Chap. 2). Such issues involve noncommensurable objectives which must be balanced as part of the political decisionmaking process. Operational officials, in contrast, rely on decision rules which do not consider the qualitative objectives involved in equity to make and justify operating or programmatic decisions. Thus, the incentives which develop in the executive agency lead to restrictive patterns of delegation where decisionmaking authority regarding distributive or equity issues is vested in the political appointee.

Parallel to patterns of centralized authority over distributive and value issues in executive agencies are patterns that maximize sources of information about those same issues to political appointees and minimize information available to subordinates. If subordinates disagree with

planned actions of superiors, knowledge of the plans provides "ammunition" in the form of information which can be transmitted, through multiple access routes, to political superiors, congressmen, or interest group members. With sufficient advance time (provided by early or "leaked" information), coalitions of opposition can be formed which will make the planned actions more difficult to undertake or infeasible. Thus, the ability of subordinates to use information about controversial or distributive issues in order to stymie the plans of political appointees, combined with the general inability of political appointees to form confidence relationships with career civil servants, can lead to incentives for political appointees to maximize their own information while limiting information available to subordinates.

Such patterns of authority and knowledge are not unknown in the private sector; but their frequency in controversial public sector programs leads one to associate restrictive patterns of delegation with the public sector. For example, the NRC manager who employed multiple avenues of access to his political superiors lost the battle in the end. After approximately two years, the immediate superior sought to control tightly information and authority available to the waste manager. The waste manager lost effective influence as a result of decreased information. Once the waste manager resigned and was replaced, a restrictive pattern of controlled information was established, and decisionmaking authority was retained at a political appointee level. What was once a decentralized and highly delegated environment reflected very quickly the centralized environment with multiple levels of review of the rest of the agency.[54]

[54] This observation is, again, based on my experience while on the NRC staff.

Procedures and Practice

Government organizations are also more likely than private companies to stress procedural regularity and caution. Again, this seems to result primarily from the need to justify actions as part of accountability mechanisms and control from outside the agency.

The need by public institutions to document and justify decisions leads to development of decision rules. These rules are often applied to circumstances which are unanticipated and which may vary greatly from those originally conceived. For example, NRC is now in the process of developing safety goals for nuclear power plants. This is in response to the recommendations of President Carter's Commission on the Accident at Three Mile Island. One of the top legal officials within the NRC has stated that these goals should not be used in making licensing decisions. He takes the position that decision criteria should be "susceptible to a definitive answer applying data and generally accepted scientific principles." Moreover, he states that "you are better off ... with quantitative safety goals than with qualitative safety goals because qualitative safety goals ... are susceptible to ... interpretation and different kinds of application." [55] His basic point is that in the process of making and defending complex technical decisions, the decision rules, when applied, should result in a decision which conforms to agency policies. If the decision rules do not exist (and therefore cannot be applied), under the press of controversy and competing demands (for example, during an adjudicatory hearing), decisions will not be fully thought out in advance. In other words,

[55] See Inside N.R.C., April 19, 1982, p. 6.

policy planning should come during the preparation of decision rules and not during the deliberations for a specific facility.

As a consequence of adherence to decision rules, routine federal decisionmaking for a specific facility often does not take into account the concerns specific to the host community. For example, emissions permissible under NRC and EPA standards might result in potential radiation exposures that citizens in a potential host community find unacceptable. NRC and applicant adherence to regulatory guides, however, do not consider the differences among communities in the level of risk or type of risk which they consider acceptable. In a community which considers the NRC standard too high, citizens will likely oppose the plant. Such opposition will be resolved by third-party decisions such as by a licensing board or court. These processes are often time-consuming and costly. A private firm, on the other hand, siting a potentially hazardous facility such as a liquid natural gas terminal can design the facility in a manner which is more acceptable to the local community even though the firm might limit emissions to levels below those allowed by EPA standards for exposure to hazards. The more responsive approach available to a private firm is capable of limiting opposition from the outset and reducing the potential for delay.

In a second example of procedural regularity in executive agencies, discrete activities are measured and evaluated in place of measuring progress toward overall goals (e.g., increases in public health and safety). Decision rules and proxies for qualitative goals[56] are

[56] For example, an agency such as the EPA responsible for protecting public health is unable to directly evaluate its own performance. In order to provide some measure of performance, officials often substitute a proxy such as number of permits issued or regulations written as a way of demonstrating performance.

substituted in the form of regulations and rules of practice which become "standard operating procedures." SOPs are vital for the smooth functioning of an organization; they allow routine tasks to be performed without lengthy reconsideration of means or objectives. But proxies which substitute for qualitative goals take the place of the real objective which becomes lost. The organizational unit derives its purpose from the measurable proxy. In this case, the SOP is reinforced by past behavior and difficult to challenge. In the section on accountability, we saw that proxies and decision rules can prevent the consideration of new information and different points of view.

Equity is frequently defined by executive agencies in terms of procedural regularity. For example, due process, as guaranteed through formal procedures, appeal, and hearing processes, is considered to ensure equitable public personnel practices, entitlement programs, and application of health and safety regulations.

Hiring practices in the public and private sectors are also substantially different. The private company has incentive to develop professional managers and to groom top-performing middle-level executives for top positions. At the extreme is the company which advances managers almost exclusively from within. An example is contained in Chap. 6. Managers are rotated throughout the company into positions for which they have an aptitude and interest. Several executives are considered contenders for each of the top jobs. In addition, managers are hired from the outset for their managerial potential. There are separate technical and managerial advancement tracks so that only individuals who demonstrate good management skills

become responsible for decisions which have large effects on profitability.

Federal hiring and promotion practices provide a sharp contrast. The tendency of federal hiring policies is to emphasize hiring for specific low- and mid-level management positions rather than for long-run potential. Specific job vacancies are announced and filled generally without consideration of potential advancement opportunities or skills needed for potential future assignments. Moreover, the top positions go to political appointees who often are without experience in the agency or substantive field.

SUMMARY

The differences in the institutional environments facing public and private organizations which site noxious facilities are summarized in Table 2. Table 3 summarizes the behavioral implications of these differences for the internal administration and management of those organizations.

The next chapter examines how the different institutional environments and resulting behaviors differentially affect the ability of private companies and executive agencies to develop the capabilities (described in Chap. 2) necessary to overcome sufficient opposition in the external environment to site noxious facilities.

Table 2
INSTITUTIONAL ENVIRONMENTS--SUMMARY

Environmental Factor	Public Sector Executive Agencies	Private Sector Companies
ACCOUNTABILITY AND CONTROL FROM OUTSIDE THE ORGANIZATION	Cannot take action unless legally authorized	Can take actions not legally proscribed
Administrative Mechanisms for Oversight	Public and agency* scrutiny of: • proposed activity and consequences • policy objective • alternatives considered • communication with outside groups and individuals • decisionmaking process • dissenting opinions Challenge through permit review, public hearings, rulemaking procedures, and litigation	Public and agency* scrutiny of: • proposed activity and consequences Challenge through permit review and litigation
Control by the Executive Branch	Control over budget requests Oversight through the execu- tive offices of the President Personnel appointments	No formal authority over budgets, organization, objectives or personnel**
Legislative Control	Authorizes and appropriates funds for activities Can prescribe organizational form Confirms Presidential appointments	No formal authority**

*"Agency" refers to federal and state agencies responsible for administering oversight and regulatory statutes.

**Executive and legislative branch decisions can affect the feasibility and attractiveness of alternatives considered by private firms.

Table 2--CONTINUED

Environmental Factor	Public Sector Executive Agencies	Private Sector Companies
	Congressional investigations and other means to influence specific activities	Occasional congressional hearings
Effect of Popular Elections	Upper level of management likely to change	Mergers and other rapid changes in management of private firms present an incomplete analogy
	Programs and policies subject to rapid change	
	Potential funding changes	
	Creates programmatic uncertainty	Might create programmatic uncertainty because of environmental change*
NATURE AND CLARITY OF GOALS	Greater tendency than private sector toward: <ul style="list-style-type: none"> • multiple and diverse goals • noncommensurable goals • conflicting goals 	Operational goal: (constrained) profit maximization
	Oversight mechanisms and multiple avenues for access allow constituency groups to evaluate agency performance against singular goals of interest to them	Can consider competing objectives as constraints on profit objective
	Difficulty maintaining a stable political "solution" in controversial programs as a result of multiple noncommensurable goals and multiple avenues of access available to interest groups	Can choose scope and timing of bargaining with external actors

*Examples of environmental change are creation or elimination of subsidies, taxes, and regulations.

Table 2--CONTINUED

Environmental Factor	Public Sector Executive Agencies	Private Sector Companies
ACCESS TO ECONOMIC RESOURCES	<p>Budget authorized and appropriated by Congress (possibly supplemented by user fees)</p> <p>Capital construction investment decision process:</p> <ul style="list-style-type: none">• public need• project definition• advocacy by agency and potential "winners"• piecemeal appropriation• annual reviews and potentially frequent policy redirections	<p>Marketplace: prices charged for goods and services sold to buyers plus return on investment in capital markets</p> <p>Capital construction investment decision process</p> <ul style="list-style-type: none">• economic need/opportunity• project definition• roi* ranking• fund top-ranked projects• project duration planning horizon

* Return on investment.

Table 3

THE BEHAVIORAL IMPLICATIONS OF DIFFERENCES IN INSTITUTIONAL ENVIRONMENTS

Internal Administration	Public Sector Executive Agencies	Private Sector Companies
Flexibility to Allocate Funds and Terminate Projects	Control and influence over funds substantially from outside the organization leading to inflexibility to reallocate funds	Control and influence over decisions from within organizations leading to freedom of allocation
Roles of Officials in Obtaining Resources	Substitution of proposed construction as objective displacing original objective (e.g., public safety) and resulting in difficulty in evaluating alternatives	Greater ability to maintain profit objective as operational objective against which alternatives are measured
Time-Horizon	Annual or shorter review cycles result in frequent policy changes for controversial programs--heightens program manager's uncertainty and can create reluctance to perform meaningful long-term planning	Freedom to set milestones according to logic of project
	Review process unrelated to logic of construction project Rate of time discount of high-level officials higher than private sector	
Authority Relationships	More tenuous control by top management than in the private sector because of (i) multiple appeal and access routes to political superiors and (ii) lack of credible sanctions	Largely independent of external environment

Table 3--CONTINUED

Internal Administration	Public Sector Executive Agencies	Private Sector Companies
Procedures and Practices	Patterns of delegation which maximize authority and sources of information regarding distributive and value issues to top-level officials and minimize control over distributive, equity, and nonroutine issues exercised by subordinates	
	Stress procedural regularity and caution and reliance on decision rules to respond to high degree of scrutiny and to maintain equity	Largely independent of external environment
	Hiring emphasizes specific position for mid-level managers	Incentive to develop professional managers
	Political appointees fill upper-level management positions	Incentive to provide for orderly management succession

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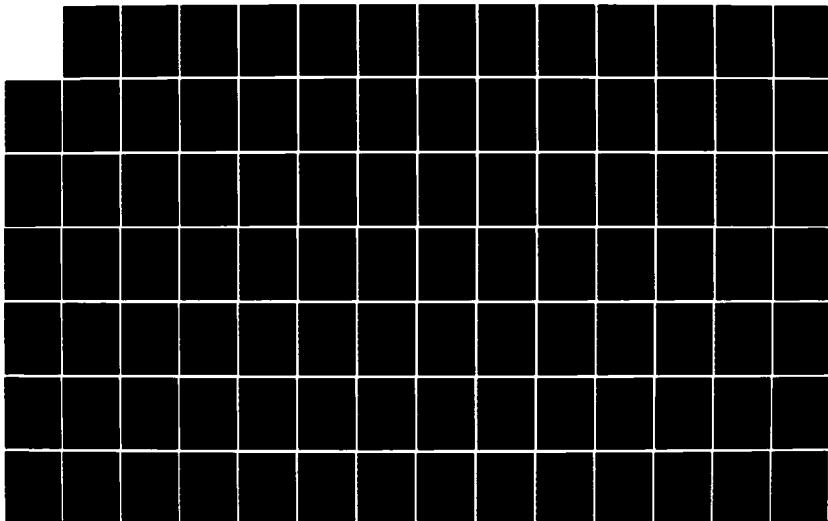
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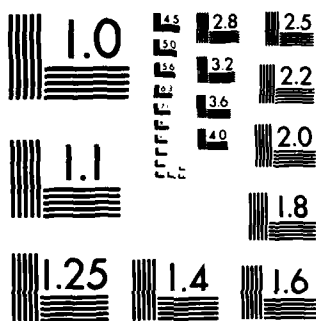
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IV. IMPLICATIONS FOR SITING NOXIOUS FACILITIES

In this chapter, I will argue that as a direct outcome of the differences in the institutional environments discussed in Chap. 3, federal executive agencies are severely disadvantaged if not incapable of siting noxious facilities relative to private companies. Based on the observations of the previous chapter, I hypothesize that

1. The career civil service (or program managers) in executive agency siting programs will tend to be inflexible in their response to external conflict. Two important behavioral causes are
 - a) the likelihood that top executive agency officials will not delegate decisionmaking to line officials along with guidance necessary to allow rapid and differential responses to different sources of conflict and tactics, and
 - b) reliance by executive agency operating officials on decision rules and procedural regularity.
2. Executive agency program managers face more competing and noncommensurable objectives (which are frequently renegotiated in the political process) and are thus unable to balance competing objectives or to treat them as constraints.
3. Executive agency policies and program directions will be unstable over the length of time required to site a noxious facility.

In this chapter, I elaborate on the terse statement of hypotheses above. That is, I draw on the analysis of Chap. 3 to amplify how the three hypotheses were formulated. Chapters 5 and 6 analyze one public sector

and one private sector case, respectively, to provide evidence in support of the hypotheses.

FLEXIBILITY TO RESPOND TO THE INSTITUTIONAL ENVIRONMENT

In the public sector, flexibility is constrained by diverse environmental factors. The result is an inability of a program manager (a member of the career civil service), in the short run,[1] to respond to opposition from external groups with programmatic changes which are responsive to the source of conflict. First, a federal executive agency is subject to a high degree of scrutiny regarding the decisionmaking process and a wide set of controls or access points external to the organization to obtain information about and influence that process. Second, it faces an environment with multiple vague and noncommensurable goals which defy a common metric. Thus, it is difficult to judge progress toward meeting the various goals. In the absence of a metric for evaluation, it is not uncommon to substitute behavioral rules and SOPs as proxies against which to measure performance. Third, ideas, initiatives, responses, and other activities must go through multiple, and often slow, layers of review and approval. Fourth, procedural regularity and decision rules are used by political and operational officials, respectively, to proscribe or justify the behavior of operating officials. These rules and procedures are routinely applied and difficult to challenge both from inside and from outside the agency. Fifth, an executive agency has limited abilities to redirect resources without approval from the Congress or President. The manner of access to resources creates advocates for a specific project definition and

[1] The short run would include the periods between disruptive changes in tenure. Usually, the short term would not be longer than two years and might be considerably shorter. Potentially, it could last the duration of a presidential administration.

approach. Agency officials not only define their professional existence according to the desirability of a proposed facility but are also placed in a position of defending that facility in a particular configuration in order to gain access to economic resources. Finally, program managers are charged with implementing policies which arise from a relatively unstable bargaining process. That is, solutions are defined, not with respect to agreed-upon objectives which have a common metric, but to satisfy multiple important interested parties in order to establish a winning political coalition in support of a given project. The bargained political solution is time-consuming to achieve and often expensive and is therefore difficult to abandon even when additional information proves it infeasible or a less desirable alternative. Moreover, if with additional information, program maturity, or changes in political leverage the bargained solution no longer represents a winning coalition, the dimensions of a new coalition and new bargained solution are uncertain. The career program manager is particularly unwilling to disturb the political bargain. These very diverse elements result in incentives, work attitudes, authority relationships, and coalitions which resist flexible and differential programmatic (as opposed to political) responses to environmental stimuli.

The reduced need to justify programmatic decisions to outside groups, the fewer access points, the availability of a common metric (profits) which allows competing objectives to be treated as constraints, the greater ability to redirect resources, and the ability to influence the scope and timing of bargains will make private sector siting programs relatively more responsive to opposition in the external environment.[2] Of course, organizational factors will also create a

[2] I am not arguing here that all companies will learn to deal

certain amount of inertia in the private sector. March and Simon (1958), Thompson (1967), and other scholars of organizational behavior describe all human systems as being somewhat reluctant to change. Notwithstanding these realities, private companies can develop internal incentives to more accurately assess the constraints or factors such as external conflict which will affect the costs or revenues of a proposed facility. For example, if a private manager fails to anticipate and limit opposition (within his area of responsibility) which will affect the ability of the company to achieve strategic goals or to earn profits on a particular venture, he is likely to face sanctions (e.g., dismissal or failure to receive a promotion). Once a project is underway, the private official has incentives to modify program specifics to maintain the prospects for an acceptable rate of return (especially if the alternative is a net loss or the abandonment of monies already invested). Thus a private official is more likely to seek information about potential obstacles and rapid remedies to external conflict than his public sector counterpart.[3]

In Chap. 2, I argued that authority to communicate with and reach agreements with most external groups which might oppose the construction of a noxious facility should rest with the operating staff. The institutional environment of executive agencies makes such delegation

with issues of conflict in the external environment. Companies which fail to adapt will suffer declining profits relative to competitors.

[3] Companies display substantial differences in the kind of remedies they seek, depending upon the issues involved, corporate culture, assessments about probabilities of success, and corporate history. For example, some companies, such as the Dow Chemical Company, have historically sought litigated remedies while other companies, like Dupont, seem more apt to seek negotiated or bargained remedies outside the courtroom. The explanations for the choice of strategies to overcome opposition are beyond the scope of this study.

extremely difficult to achieve. First, such a pattern of delegation would weaken the fragile control[4] which political appointees can exercise over agency staff. Siting of noxious facilities often requires day-to-day contact with affected groups and individuals. Such groups include state and local government agencies, local citizen groups, and other interested groups. This is the political realm; that is, these groups individually or collectively can employ mechanisms to oversee or influence the activities of executive agencies. They potentially can affect the time and effort required by the agency to undertake tasks mandated by Congress or the President,[5] the funds available to the agency and the use of those funds, and the reputation of public officials and their relationship with their political superiors and the Congress. Not surprisingly, top public officials limit contact between their staffs and the public. If contact is left unlimited and unguarded, agency staff who disagree with the policies of political superiors can easily employ access to these public groups to indirectly influence their superiors. Second, given the limited tenure of political appointees and the incentives to minimize control exercised by subordinates, it is very difficult to develop the trust necessary for delegation to the operating staff. Finally, political appointees are implicitly judged on the political desirability of activities. Thus, it is unlikely that a top manager will delegate those very responsibilities on which his professional future might depend.

[4] Control is largely exercised through withholding of information and authority.

[5] Means of influence range from filing requests under the Freedom of Information Act to filing of legal petitions or appeals of agency actions. Such tactics can be employed to divert time and effort from other agency responsibilities and efforts.

The outside groups which can influence an agency's mandate, budget, and staff do not have equivalent mechanisms to control private firms. Thus, upper management does not fear loss of control to subordinates. While it is unlikely that the learning process in the private sector will be smooth, the incentive structure is more likely to allow delegation of authority to the operating staff. External groups might affect the ability of a firm to conduct a specific activity thereby influencing the profits of the company. Nonetheless, with accurate information the firm can choose to undertake different activities which are more politically feasible or can modify the original project to increase its likelihood of success.

Two factors complement the greater control of private high-level officials. First, the incentives to develop (a) professional managers and (b) a line of management succession will encourage firms to give operating officials opportunity to develop skills to effectively deal with the public. Second, corporate managers will want to limit time spent "fire-fighting" on the local front. Corporate management is judged according to the profitability of a firm. Time spent personally negotiating with or cajoling opponents distracts from this goal. If anything, management is judged to fail if the tasks of assessing and mitigating constraints to operations do not become routine.

Another difference between the two sectors which affects their respective flexibilities comes from their differing abilities to gather information. There are basically two methods to gather information: passive observation of the environment and active participation in the environment. While passive observation will yield a large range of

information, important aspects of conflict cannot be determined without asking questions and holding discussions with those potentially interested in or affected by a proposed project.[6] A private company can choose either method or combination of methods. Since communication by private officials with external groups is not subject to direct public observation, private (behind closed doors) discussions and negotiation are possible if the company chooses to operate in such a fashion. Further, a private company can contract with other companies to gather information about potential sites and issues prior to announcing its intentions. Such mechanisms can be used to eliminate unacceptable sites and to develop contingency plans without mobilizing interests against the project. An executive agency is less able to act in secret and is restricted by the Federal Advisory Committee Act in its ability to meet with external groups in private. An executive agency traditionally engages in observation until an initial position is established. At this point, active methods (often formal public hearings) are used. But the agency, by adopting an initial position before engaging in discussions, becomes an advocate defending its established position. Such advocacy often serves to increase conflict by polarizing issues and opponents.[7]

[6] This follows because, until a potential project is defined or a potential site selected, interested parties would not have been able to identify potential impacts and therefore voice a position. With sufficient information about a potential project's consequences and the interests and stakes of those affected, a passive observer could fairly accurately predict opposition, but a great deal of information is needed to perform this assessment accurately.

[7] This has particularly characterized the federal nuclear waste management programs. It is possible to avoid the polarizing effect of proposals by providing multiple options all of which have desirable aspects. Once an agency has taken a position on any one alternative, opposition will occur from those whose interests would be adversely affected.

Flexibility is further influenced by the relative ability of the two sectors to offer side-payments. "The citizen wants fair consideration, equal treatment, and consistency..." from public sector organizations (Caiden, 1971). Side-payments by executive agencies as economic incentives (versus "just compensation" for quantifiable negative impacts) are not generally considered to be "fair consideration" or "equal treatment." [8] Executive agencies justify explicit decisions and assure due process according to decision rules which employ "objective" considerations such as health and safety, economics, or technical integrity. It is difficult under these circumstances to provide payments (in cash, services, or facilities) as a quid pro quo for siting a particular facility unless those payments are compensation for negative impacts (damages) which can be objectively measured. Not only is it difficult to provide such payments, it is difficult to ascertain what would be acceptable side-payments because of the inability to conduct private negotiations. In contrast, private companies have a history of providing economic incentives to persuade communities to accept noxious facilities. For example, in 1974, Puget Sound Power and Light Company provided payments to schools and law enforcement agencies in Skagit County, Washington, as a condition for obtaining a land-use permit for construction of a nuclear power plant (Myhra, 1975). In 1977, during further studies on economic incentives for siting, Myhra (1977) estimated that there "are about two dozen energy companies currently involved in programs (to provide economic incentives) at various locations throughout the United States." Energy

[8] Note that side-payments are a recognized and publicly accepted part of the legislative process.

companies have also become involved in "custom-building" new energy boomtowns. The objective is to anticipate and resolve the problems of towns which are dependent upon a single economic activity of a limited life span.[9]

Finally, differential flexibility is inherent in the recognition that private institutions can take actions not legally proscribed while executive agencies cannot take action unless legally authorized. Thus, if an appropriate response to external conflict involves activities not traditionally performed by the public agency, it must seek formal executive or legislative approval before undertaking such activity. For example (notwithstanding the previously stated constraints on providing side-payments), unless specifically authorized the DOE cannot divert funds to provide services or payments to potential host communities. Formal opinions regarding the scope of activity authorized or additional or clarifying legislation are time- and resource-consuming activities.

In summary, the ability to respond flexibly to external opposition requires (1) knowledge of the sources of conflict, (2) analysis of solutions which will overcome, limit, or lessen conflict, and (3) the ability to modify agency activities consistent with the resulting analysis. Operating officials have the potential to gather the information about the sources of conflict because they are on-site and deal daily with the facility development issues. But federal operating officials have little responsibility, authority, or incentives to collect such information. They are constrained by administrative controls which limit the mechanisms available for gathering information should they want to do so. Moreover, they take actions according to

[9] "Firms Seek to Avert Boomtown Problems by Providing Services," Wall Street Journal, August 12, 1981.

predetermined and often inflexible decision rules. Those rules do not generally take into account nonroutine considerations, especially distributive, value, or unanticipated issues.

Top management officials in executive agencies have the authority to respond to the sources of conflict, but they are too far removed from the daily issues of facility development to have knowledge of the sources of conflict specific to a given proposal. Furthermore, they do not have relationships with operating officials which would allow operating officials to gather and communicate this information. Finally, the range of actions available to the agency are formally limited by statutory authority. For this combination of reasons, career officials in executive agencies will tend to be inflexible in their response to the external environment.

BALANCING OBJECTIVES

As discussed repeatedly in Chap. 3, federal agencies undertaking controversial capital construction projects designed to protect health and safety or promote defense face multiple noncommensurable objectives. No common metric exists to balance, for example, regional equity in exposure to risk from waste disposal against reduction in exposure from transportation of wastes. It is because of these issues of equity and morality that responsibilities such as nuclear waste disposal are subject to federal intervention. Lacking a metric which trades off health effects and costs, federal agencies are unable to answer such questions as "how low an exposure is low enough to protect public health and safety?" Moreover, various interested groups have multiple avenues of access to advance their interests in the political process without regard for competing objectives.

Private companies can treat distributive and value issues as constraints on their internal maximization of profits. They must operate within established safety standards.[10] But, private firms can increase the safety of their facilities or systems in response to local health concerns if feasible or can choose to compensate those affected for perceived or actual risks. Moreover, a private firm has a guideline for making that choice--i.e., profitability. Thus, what are noncommensurable objectives in the public sector are constraints on profitability in the private sector and can be balanced as part of decisions on profitability. If a modification to the proposal will satisfy some outside opposition and will maintain technical feasibility and a favorable or acceptable return on investment, then a trade-off can be accepted and the facility can go forward. Modifications might be as major as pursuing an alternate site or as minor as building a fence around the facility.

LONG-TERM POLICY STABILITY

Again, several factors in the external environment of executive agencies combine to limit the stability of facility development policies and program directions over the long term. First the effect of popular elections is to disrupt policy continuity often resulting in radical policy redirections. Second, lags in management succession and gearing-up time of new appointments further disrupt programs. Third, the relatively short tenure of public officials results in a high rate of

[10] The uncertainty of many standards especially in areas of environmental protection, notably hazardous waste management, places significant uncertainty in the assessment of the strength of the constraint. But it is still treated as a constraint.

time discount by political appointees. In other words, proposal of solutions is rewarded but not the implementation of solutions especially if final implementation will occur beyond the tenure of officials. This is particularly important in facility development: Proposing to develop a facility can be viewed as a political solution without full regard to the feasibility of the proposal or potential for unanticipated consequences. When aspects of the proposed facility are found to be infeasible (e.g., the timing, siting, cost, or identification of unintended adverse consequences), the credibility of the implementing agency is damaged. Finally, the means of access to economic resources also affects the stability of policies. The program will span many years; yet the budget is approved for annual increments. Thus there are multiple points (artificial to the logic of the project) where the Congress or President can redirect the program or provide funds insufficient for the task. Redirection is frequent for controversial programs.

Long-term policy stability is much more likely in the private sector than in the public sector. The management incentives available in the private sector encourage monitoring the external environment over the full duration of the project for factors which will adversely affect the project. Funds committed to a project which goes over budget or which is later found to be infeasible reduce the profitability of the firm and would likely be better spent elsewhere. Private managers will be evaluated and rewarded (or not) on implementation as much as on the quality of the original proposal. Management tenure and succession are potentially more stable, and management turnover and related program disruption are often the remedy for poor performance, not the result of popular elections and political tides.

In summary, the institutional environment not only produces different organizational behaviors across the sectors but importantly produces differing capabilities to implement a facility development and siting program. Chapters 5 and 6, respectively, examine one public sector and one private sector siting program over approximately a ten-year period in order to provide evidence to help corroborate the three hypotheses.

V. THE DEPARTMENT OF ENERGY PROGRAM TO SITE HIGH-LEVEL RADIOACTIVE
WASTE REPOSITORIES

In order to develop evidence in support of (or to counter) the hypotheses developed in Chap. 4, two cases are examined--a public sector siting program in this chapter and a private sector siting program in the following chapter. The hypotheses are not subject to rigorous tests in this research. Rather, two siting programs are examined to see if, in general, they anticipate and respond as predicted to external opposition.

The DOE program to site high-level radioactive waste repositories is used as the public sector case. It was chosen because (1) the institutional structure for nuclear waste disposal is the subject of proposed federal legislation and has been a subject of discussion at the federal level over the past five or more years[1], (2) the author has institutional knowledge in the area of radioactive waste management, and (3) extensive literature on the history of the program is available.

The structure for evaluation allows examination of the DOE program according to the hypotheses presented in Chap. 4. A short section introduces the issues of nuclear waste management. In the second section, the history of siting--the sites explored, the reasons for those choices, the nature of opposition, and response to opposition--is examined from approximately 1970 to the present. The description

[1] As discussed in the Introduction to this report, Willrich and Lester first recommended establishment of a public corporation to dispose of HLW in 1977. Senator Percy introduced legislation concerning the creation of a new agency or authority into the 96th Congress. Most recently, an OTA report recommended, in April 1982, the creation of an independent, single-purpose waste management agency.

emphasizes the historic flexibility (hypothesis 1) of the DOE program to respond to external opposition as a function of (a) standard procedures and (b) the pattern of authority to deal with opposition. The description also examines the stability of the program goals and policies over the 12-year period (hypothesis 3). The third section analyzes the formal and informal organizational structure, delegation of authority, and lines of communication. This contributes to the "test" of hypothesis 1 by examining the current pattern of delegation of siting authority to operating officials and whether the lines of reporting and communication encourage deviation from standard procedures when new circumstances arise. The fourth section describes the current decision process for identifying, evaluating, and choosing sites and implementing the location decision. This section contributes to the evaluation of hypothesis 2 by examining the ability to balance competing objectives in arriving at siting decisions. It also provides insight to the DOE mechanisms for monitoring the external environment (hypothesis 1).

BACKGROUND

The federal government has assumed responsibility for the safe disposal of high-level radioactive wastes (HLW)[2] and entrusted statutory authority and lead responsibility to the DOE.[3] In this

[2] High-level radioactive wastes (HLW), for purposes of this report, include spent reactor fuel (if disposed of) and the wastes which result from reprocessing of spent fuel. The formal definition found in the laws and regulations of the federal government defines liquid high-level waste as "those aqueous wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel." 10CFR50, Appendix F, and the Marine Protection, Research and Sanctuaries Act of 1972, P.L. 92-532.

[3] Federal assumption of responsibility is reflected in Administrative agency budget authorizations and appropriations; the Final Report of the Interagency Review Group on Nuclear Waste Management, TID-29442, March 1979; the Energy Reorganization Act of

capacity DOE is ultimately responsible for the siting, development, and operation of facilities to dispose of HLW.[4] This is an impressively difficult and complex task which involves research and development on geologic disposal technologies as well as nationwide transport of wastes, site characterization and selection, land acquisition, setting fee schedules, securing license approvals, and numerous other implementing steps. The current responsibilities of the DOE for HLW disposal are a sharp departure from the historic responsibilities for and experience in research and development and management of existing defense HLW.

The following case will highly simplify and distract from the enormity and complexity of the task of disposing of HLW. Siting has an important position in the current and recent DOE programs and represents a relatively early programmatic task. Nonetheless, significant resources and energies are spent on nonsiting tasks such as designing a first-of-a-kind facility and research and development on appropriate waste forms and waste packages. Moreover, the bulk of the effort on siting goes into technical activities such as geologic site characterization. The safety of HLW disposal depends upon the geologic integrity of the disposal site: That is, health and safety is protected because wastes will be isolated from the human environment in mined geologic cavities. Breaches in the integrity of the site, such as fractures in rock or other pathways for radioisotopes to migrate into

1974, as amended (PL 93-438); and Title 10, Code of Federal Regulations, Part 50, Appendix F.

[4] The disposal option favored by the Administration and the majority of the interested scientific community is emplacement of HLW in mined geologic repositories.

potable aquifers or to the surface, must be avoided. This necessitates detailed geologic characterization of potential sites; characterization may take longer than four years. The technical portions of the DOE program have not been examined for this research. Nor does the chapter discuss, in any detail, the nature of the technical uncertainties or differences in technical judgment except to mention their existence, if and when they occur.

U.S. management of defense and commercial nuclear HLW has evolved in an incremental manner over the last three and one-half decades. Beginning with a rapid mobilization during World War II and for the next 20-25 years, wastes resulting from the defense program were thought of as residual materials requiring care but whose care was considered peripheral to the urgent need for nuclear weapons and nuclear-powered ships. HLW was stored in tanks (and remains stored) at the three DOE facilities that produce plutonium or reprocess spent fuel--the Hanford plant in Washington, the Savannah River plant in South Carolina, and the Idaho National Engineering Laboratory. Somewhat disparate management techniques arose among the facilities as a result of AEC policies which viewed waste management as a local clean-up operation not requiring an integrated headquarters effort. Notwithstanding operational problems,[5] plans during the 1960s for commercial management of HLW from reprocessing at the Nuclear Fuel Services plant at West Valley, New York paralleled the technology used at Hanford and Savannah River with some improvements in tank design and construction.

The basic conceptual framework for the longer term management of civilian HLW emerged from a report by the National Academy of Science's

[5] The tanks suffered loss of integrity sooner than expected.

Committee on Waste Management in 1957. The Committee noted that "the most promising method of disposal of high-level waste at the present time seems to be in salt deposits." In response, a research program was undertaken at Lyons, Kansas to determine the consequences of exposing bedded salt to radiation and heat. The program was titled "Project Salt Vault" and was led by the Oak Ridge National Laboratory (ORNL).

Consistent with the research objectives, retrieval of emplaced waste was designed into the project at the beginning. The ORNL staff consulted with the local citizenry before the project began and continued to conduct the effort in full view of the public. As a result of the openness of the project managers and the experimental and reversible nature of the venture, the local population accepted the project (Metlay, 1978).

While the Lyons effort was underway, other events led the AEC to decide to develop a repository to dispose of HLW. Specifically, a fire in 1969 at the AEC weapons facility at Rocky Flats, Colorado gave rise to a large volume of low-level plutonium-contaminated debris. Similar wastes had been routinely shipped to INEL for disposal in the AEC-operated burial ground there. Public officials in Idaho, however, were unwilling to accept the permanent stewardship of this new material and also demanded the removal of all plutonium buried there in the past. The AEC agreed to remove the waste from the Idaho burial grounds as soon as a repository became operational.

During the same period, the AEC developed a regulatory policy for commercially generated wastes.[6] Among other provisions, the regulation required that solidified wastes be "transferred to a Federal

[6] The policy was codified in 1970 as Appendix F to 10 CFR 50.

repository no later than 10 years following the separation of fission products from the irradiated fuel." This marked a decision by AEC that the federal government had responsibility for the custodianship and permanent disposal of HLW. It reversed a prior decision, made in the mid-1960s by AEC in licensing the commercial reprocessing plant at West Valley, that the permanent disposition of commercial HLW was not a federal responsibility.

Thus, the AEC promise to remove plutonium waste from Idaho and the now officially acknowledged need for a federal repository for defense and commercial wastes caused the AEC to transform the Kansas salt mine from an experiment to a prototype HLW repository. The decision was announced in June 1970. This marks the first attempt to site a repository and brings us to the beginning of the period of interest.

SITING EXPERIENCE[7]

Opposition to using the Kansas site for disposal of HLW developed very quickly. One source of opposition was differences in technical judgment. The safety of using the mine for disposal of HLW was questioned by a group of Kansas geologists and other scientists. One of the primary questions was whether drill holes could be successfully

[7] The siting history recounted here is based on (1) interviews conducted in 1980 as part of a previous study, the results of which are reported in N-1650, (2) knowledge gained by the author over the past six years while working on nuclear waste management issues, (3) program documents of the AEC and its successor agencies including ERDA, DOE, and NRC, and (4) the following two documents: Daniel S. Metlay, "History and Interpretation of Radioactive Waste Management in the United State," Essays on Issues Relevant to the Regulation of Radioactive Waste Management, NUREG-0412, Nuclear Regulatory Commission, May 1978, and Randall F. Smith, Strategies for Siting Nuclear Waste Repositories, doctoral thesis, J. F. Kennedy School of Government, Harvard University, Cambridge, Massachusetts, April 1981. I have not indicated which was the source of any particular item recounted unless the source is quoted directly or the concept represents a subjective judgment.

plugged in order to maintain the integrity of the site. A second technical question arose when a nearby salt mine increased its solution mining activity leading to concern about ground-subsidence near the proposed repository. Finally, it was discovered that, during solution mining some five years earlier and less than three miles from the proposed site, approximately 175,000 gallons of water had disappeared--introducing another threat to the integrity of the site. Kansas scientists felt that these circumstances posed substantial technical uncertainties and that, at a minimum, further studies should be conducted before a decision to construct a repository was made. The AEC took the position that these problems could be resolved and should not halt progress.

The technical issues, heightened by a concern that the federal government (in its rush to meet short-term political obligations) would not protect local public health and safety, provided a basis for political opposition. Although the people of Kansas had been receptive to the idea of experimentation at Lyons, the change in intention caused distrust of the AEC. The distrust was aggravated by the lack of regard AEC scientists showed for the technical issues raised by local scientists. Opposition was led by the Kansas Congressional delegation--Congressman Joseph Skubitz and Senators Robert Dole and James Pearson. Governor Robert Docking also joined in opposition. In 1971, as a response to the political protest, Congress passed an amendment to the 1972 AEC authorization bill which prevented the AEC from implementing the Lyons waste repository project until an advisory commission certified that the project was safe. In response to more immediately pressing political pressures, the Lyons project was canceled. The 1972 authorization bill

was soon followed by a warning from the Nixon White House to the AEC: do nothing to rock the boat this close to the election. The new AEC Chairman, James Schlesinger ... (was) especially sensitive to this plea. Slowly, Lyons faded into the background. By February, 1972, the repository project in Kansas was officially dead. (Metlay, p. 6)

Two themes can be discerned from this initial experience which still characterize the federal program for HLW disposal. First is the political question of whether a siting decision can be imposed by the federal government or whether local, state, or other external control can, instead, dilute federal authority. According to one interpretation of the Lyons incident, AEC never recognized the importance of external opposition and the reality of external influence over its actions (Smith, 1981). Second is the potential importance of credibility and trust in the federal program and federal organizations. In this siting instance, Metlay concludes that (1) the unwillingness of the AEC to consider seriously the concerns of the state officials and scientists combined with (2) the abrupt change of intentions without benefit of consultations with state and local officials led to opposition because of decreased trust in the federal decisionmaking process.

Several other ways of disposing of long-lived HLW were then considered by AEC including such possibilities as space disposal, transmutation of radionuclides into nonradioactive substances, and seabed disposal. None of these alternatives was sufficiently researched to base a policy around, and it was determined that a new practical concept had to be developed for the short term. The time pressure came from the political obligation to remove the wastes from Idaho.

Under the leadership of James Schlesinger as Chairman of the AEC and Frank Pittman as Director of the Division of Waste Management, the concept of a Retrievable Surface Storage Facility (RSSF) was developed. According to this concept, HLW would be stored in engineered surface or near-surface structures. Storage was to be temporary; wastes would be retrieved and transferred to permanent storage when a repository became available. This policy was announced by the AEC in May 1972, and in September 1974, a draft environmental statement (DES) on the RSSF was circulated. The strongest critical voice was that of the EPA, which said, among other things,

A major concern ... is the possibility that economic factors could later dictate utilization of the facility as a permanent repository, contrary to the stated intent to make the RSSF interim in nature.

The DES received EPA's lowest category of evaluation. In April 1975, the request for funds to build an RSSF was withdrawn by the AEC.

During 1975 and 1976, the recently formed Energy Research and Development Administration (ERDA)[8] considered the technical alternatives available for disposal of radioactive wastes. Six major candidate technologies were evaluated for disposal of HLW:

- Placement in mined geologic repositories;
- Placement in deep ocean sediments;

[8] In January 1975 the operational and regulatory responsibilities of the AEC were split into ERDA and NRC respectively. Whereas AEC had been completely self-regulating, NRC was given regulatory responsibility over ERDA (now DOE) facilities for HLW disposal.

- Placement in very deep drill holes;
- Placement in mined cavities in a way that leads to rock melting;
- Partitioning of reprocessing waste and transmutation of heavy (long-lived) radionuclides; and
- Partitioning of reprocessing waste and ejection of (long-lived) heavy radionuclides into space.

The federal agencies, organized under the auspices of the Energy Resources Council (ERC), returned to the idea of geological disposal of HLW as both their goal and their major programmatic thrust.[9] By 1975, the research effort for the disposal of commercial nuclear waste being carried out by ERDA was focused on stepped-up efforts to locate several sites for geologic repositories in bedded or domed salt. The operational task of site selection was contracted to the Office of Waste Isolation (OWI) part of the Union Carbide Nuclear Division, the contractor that operated the Oak Ridge National Laboratory.

The first site focused on by OWI (in 1975) was in Alpena, Michigan. In response to the criticism that ERDA officials had not consulted adequately with Kansas scientists, ERDA and OWI officials met with technical people from the state. While still doing "paper studies," meetings were held with the state geologist and with the Michigan State Geological Survey. In May 1976, approximately six months after these first discussions, ERDA notified an official from Governor Milliken's

[9] Again, the decision to pursue mined geologic repositories resulted from the extent of thinking which had already gone into the concept and because of the relative states-of-technology of the other concepts.

office and Congressman Phillip Ruppe, in whose district Alpena lay, of its intention to start exploratory drilling activities. In response to being confronted with what appeared to be a fait accompli, Governor Milliken insisted on veto rights over the proposed repository before ERDA could proceed with on-site investigations. Congressman Ruppe called for hearings. Press coverage became heavy about this time. ERDA operating officials stated to the Detroit Free Press their inability to grant state control or veto over waste program activities. The headline ran "U.S. Denies State a Veto on A-Dump." The same ERDA officials, nonetheless, intended to discuss investigation activities fully with state officials. In conflict with the position made public by operating officials, ERDA head Robert Seamans stated that ERDA would not dispose of wastes in Michigan against the wishes of the citizens of the state. The apparently conflicting statements and failure to involve state political officials from the beginning resulted in still heavier adverse news reporting. In September, Seamans wrote to the Governor to assure him that ERDA activities would be terminated if the State raised issues dealing with site selection criteria that could not be resolved to the mutual satisfaction of ERDA and the state. In May of the following year, Governor Milliken requested ERDA halt investigations in Michigan. ERDA complied with the request.

Smith, after extensive review of original news reporting and interviews with state officials, discerned three major issues. First, neither ERDA nor OWI (nor the state geologist) seemed sensitive to who should be involved in initial discussions nor had ERDA and OWI assigned responsibility between them for making contact. The lack of coordination for communicating with outside actors contributed to a

feeling by the citizenry that ERDA was trying to "sneak something by." Second, the lack of a clear policy toward the rights or authority of the state further exacerbated the issue of trust and credibility. Third, ERDA officials had a difficult time "defending the reasonableness of their focusing on Alpena" which brought into question the criteria and decision process used for the program. Many citizens of Michigan and others outside the local community believed that the choice of Alpena represented a de facto site choice and not a decision to gather information. In other words, the good-faith intentions of ERDA were doubted. Thus, the three issues identified by Smith are related to the lack of credibility of or trust in the federal agency. Underlying the issue of trust were general concerns[10] for protection of public health and safety and of distribution of risks and responsibility.

Notice in this siting episode (and as predicted in hypothesis 1) the separation between operating officials and political appointees within the federal agency. Site selection was considered an operational task. The operating officials had no training,[11] responsibility, or familiarity with the local community which would allow (or encourage) them to consider potential external opposition in the site selection and investigation process. They responded to public questions, concerns, and demands with statements about established agency positions. The result, in the Alpena episode, was directly conflicting statements of agency policy: one statement from operating officials of standard

[10] The technical and health and safety concerns raised in Michigan were concerns that could be raised with regard to waste disposal anywhere in the country. In contrast, the concerns raised in the Lyons episode were specific to the chosen site.

[11] The primary task was geological site characterization. Thus, the operating officials were technically trained and had experience conducting research and development programs.

operating procedures and one statement from political officials of a policy tailored on the spot to the special circumstances of Alpena. The inconsistent policy statements undermined the relationship between the operating officials and the external groups. Problems created by a separation of operating and management officials continue to present problems in later siting efforts.

Following the failed efforts in Michigan, ERDA (and OWI) began a more intensive effort to site and develop a bedded-salt repository. The heightened effort was in direct response to a major message by President Ford on nuclear energy (timed a few days before the 1976 election). The President called the management of HLW a high-priority element of a national energy plan and set 1985 as the date when a geologic repository would be put in operation. Budget authorizations for FY77 reflected the new priority. Thirty-six states were identified with geologic formations of interest for disposal of HLW. ERDA informed by letter all 50 states of the repository program and extended the same promise given to Governor Milliken: that activities would be terminated if the state raised issues dealing with site selection criteria that could not be resolved to the mutual satisfaction of ERDA and the state. OWI proceeded with investigations, roughly concurrently, in six of these states: Louisiana, Mississippi, New York, Ohio, Texas, and Utah.[12]

Consistent with the behaviors predicted in Chap. 4, the ERDA program (1) was designed to establish and rely on decision rules for evaluating the technical acceptability of sites (e.g., seismic

[12] Fieldwork was supposed to be conducted in 13 of the 36 states during FY77. The 13 were considered to have geologic formations which were more promising than those in the other states. No documentation was found which explained why work proceeded in only six of the 13 priority states.

stability) and (2) separated traditional operational tasks such as field investigations from political or distributive decisions such as responding to political constituency groups. The program was a research and development program. That is, the problem was defined as a research task, i.e., identifying a site which satisfied technical requirements for protection of public health and safety. The criteria for site selection were restricted to technical considerations such as seismic, hydrologic, and geochemistry issues. Nonintrusive field investigations were to supplement the information already available from the U.S. Geological Survey. It was thought that, after additional data was gathered, subregions of interest could be identified. Field tests including bore-hole drilling and other intrusive tests would be used to identify technically acceptable sites.[13]

In response to public opposition in Lyons and Alpena, a public information program was developed to supplement the technical program. The purpose of the program was to inform the public about the plans and activities of OWI and ERDA. As part of the program, public meetings and briefings of state officials were held and correspondence exchanged. The charter did not include responsibility to anticipate and identify potential or actual issues of concern. Nor did it include authority to respond to equity issues, public expectations, or differences in levels of acceptable risk except by providing information about the agency's activities.

Complementing the information/education programs, several advisory committees were established. These committees (with 20-50 members)

[13] The site selection process was hampered then and continues to be hampered by the absence of formal standards for what constitutes an acceptable site. NRC and EPA, chartered with developing regulations, have been working on their respective rules since 1975.

included recognized physical scientists and social scientists from the academic community, representatives of the environmental community, industry, and nonpartisan public interest groups such as the League of Women Voters. Separate advisory committees reported to the DOE contractors, field offices, and headquarters.

Investigations in Louisiana and Mississippi followed similar courses. They started in 1977 and continue today. The Louisiana experience is briefly recounted here. OWI met with a generally hostile response. A primary issue involved the distribution nationally of risk from and responsibility for waste disposal. Opposition took the form of questioning the standards for site selection--OWI/ERDA (and later DOE)[14] were unable to articulate reasons for choosing Louisiana over other states with salt formations. Secondly, the extent of state power over any eventual decision to emplace wastes arose anew. Louisiana became one of the earliest states to pass state legislation asserting control over federal waste disposal activities.[15] Supplementing the state legislation, Governor Edwin Edwards negotiated a formal agreement with the DOE according to which Louisiana agreed to permit the U.S. government to store petroleum in Louisiana salt domes (for the Strategic Petroleum Reserve) in return for a guarantee that no nuclear wastes

[14] In October 1977, the DOE was formed subsuming the ERDA plus other federal energy organizations. NRC remained an independent regulatory agency. Also note that in mid-1978, DOE transferred contractual authority for the waste isolation program from OWI at Oak Ridge to a new contractor, a division of Battelle Memorial Institute called the Office of Nuclear Waste Isolation (ONWI).

[15] A readout from an Oak Ridge National Laboratory data file listed 217 statutes introduced or enacted by states limiting federal nuclear waste activities as of June 1979. The NRC and Sandia Laboratories maintain similar data files as a way of keeping up with voluminous state legislative actions in the area of nuclear waste management.

would be stored or disposed of in Louisiana without its consent. One year later, in response to a Freedom of Information Act request, DOE released an internal memorandum in which DOE officials stated their opinion that DOE lacked the statutory authority to commit to a state veto, and, therefore, was not legally bound by the 1978 agreement. In response, Secretary Charles Duncan stated that DOE had a "moral obligation" but possibly not a legal one to honor the Louisiana agreement. Meanwhile, a DOE project engineer stated publicly that Louisiana has "nothing different (in terms of veto rights) than any of the other states" (statement requoted from Smith, 1981, p. 105). In response to the confusion and resulting public opposition, Senator J. Bennett Johnston and Representative Jerry Huckaby (in whose district one of the domes of interest lies) both introduced legislation or amendments which would rule out siting of a federal repository in Louisiana.

Thus, the controversy in Louisiana bore striking similarities to that in Alpena--mixed signals from DOE as to the extent of state power over any eventual decision, intervention by members of the Louisiana congressional delegation, and continually increasing political heat. (Smith, p. 105)

Notwithstanding the opposition voiced by state officials and signs of increasing public concern, no formal request from either governor to DOE to halt activities has been made. As mentioned, investigations continue today in both states but no land has been purchased or otherwise withdrawn from the public domain.

Officials of Ohio and New York opposed DOE investigations from the beginning. Before significant efforts were expended, the governors of both states requested that DOE halt activities. DOE complied with these requests.

Activity in Texas has been relatively quiet and slow. Sufficient investigations were done in the state to narrow the regions of interest. Potential sites were ruled out by DOE for technical reasons. During the period of DOE field investigations (1977-1980) no direct confrontations arose, but several attempts through the courts and the legislature were made to oust DOE. For example, Randall County Commissioners requested a permanent injunction against DOE drilling in the County. The Texas district court denied the request. Bills were also introduced in the state legislature to ban shipments of waste into the state from outside the state's borders.

Activity in Utah, also initially slow, has heated up since approximately 1980. Unlike the other states investigated, some citizen groups within the state favor the siting of a nuclear waste repository in the state. For example, NuclearFuel reported in April 1982, that

Nearly all of the elected officials and business leaders in Grand and San Juan counties, the center of Utah's uranium mining industry, signed a petition supporting location of a nuclear waste dump just east of Canyonlands National Park.

The signatories readily admit that the petition is in direct response to an organized protest led by the Grand County Concerned Citizens Coalition. The protest is supported by local and national environmental groups (e.g., local Utah chapters of the Sierra Club and the National Parks and Conservation Association). Environmental opposition centers around the site's proximity to the Canyonlands National Park. Governor Scott Matheson recently joined the controversy by urging the Bureau of Land Management (BLM) (which administers the land of interest) to prepare a "full-blown" environmental impact statement before issuing permits to the DOE for exploratory drilling.

One of the specific questions raised by Governor Matheson hinges again on adequacy of the criteria for selecting the site near the Canyonlands for additional exploration. In 1980 DOE requested Department of Interior (DOI) permission to drill on this land which is under consideration by BLM for wilderness designation. The request was accompanied by documentation required by NEPA which considered the narrow issue of the impacts of field investigation at the site. It failed to address why the site was chosen in preference to others or the long-term implications of waste disposal at the site. Public hearings on the proposal to perform site investigations were held in local communities. Newspaper reporting of the hearings reflect primary interest in these larger questions and criticism of the formality and narrow scope of the hearing process. Prior to the request, DOE was unaware that the land was being evaluated for wilderness designation. The request could have been anticipated to result in protests from environmental groups, DOI itself, and possibly from local residents; such opposition quickly arose. Yet the opposition came as a surprise to DOE operating officials because the standard procedures did not include communication with most of those in opposition or evaluation of how the proposed action would affect the interests (sense of well-being, economic, and political) of state residents. In a related action, the DOE abandoned a potential site near Elk Ridge, Utah--a less environmentally sensitive area of the state. According to Governor Matheson, the information available to the state regarding the decision to drop one site (Elk Ridge) in favor of the site near the Canyonlands "indicates scant attention was given to ecological sensitivity, aesthetics, archaeology, transportation access and other issues."

The verdict is still out on the OWI/ONWI/ERDA/DOE efforts to locate a bedded-salt repository site. There are important similarities among the siting experiences in the six states. The responses of the DOE at the operating level are consistent with the relatively inflexible behavior predicted by hypothesis 1. The DOE failed to assess whether conflict would arise or the specific nature of potential conflict. As conflict did arise, it was dealt with by relying on (1) procedural arrangements such as agreements of cooperation, (2) information programs, and (3) formal advisory groups and public hearings. These efforts, while well-intentioned, did little to resolve or limit conflict and sometimes exacerbated opposition.

After opposition become a routine part of field investigations, ONWI was called upon to consider the implication of such opposition. This task was further subcontracted to the Human Affairs Research Centers (HARC), a division of Battelle Memorial Institute. Consistent with the requests of DOE, the information gathered and analysis performed by HARC has concentrated on (1) the formal and informal power of states and localities to halt the development of repositories and (2) procedures for cooperation between the DOE and potential host states. Incidental to this analysis, some information was developed about the general concerns of states or localities. Little information was gathered about the interests of specific groups, and this information was not used to select states or subregions. Nor was it used to respond to the specific issues raised by opponents (except for the states' right of veto authority). For example, groups in Utah, Louisiana, and Michigan are still demanding site selection criteria which include

equity and distributive considerations. DOE is not developing such criteria. It has agreed to develop procedures to discuss the issues.

We have seen that the effort to locate a site in salt has been characterized by a separation of political officials and operating officials. Operating officials dealt with local leaders and public interest groups on a routine basis but had no authority to respond to their concerns except by providing information and convening or attending meetings.[16] They were outsiders to the local communities not having established field offices at the locations being investigated. Their lack of authority to act combined with their lack of familiarity with local interests and concerns resulted, at times, in community and interest group leaders going "above their heads" to their political superiors. When superiors responded to concerns (for example, by agreeing to grant a state veto authority), the standing of the operating official was undermined. This process further hampered the agency's and officials' credibility. Political appointees in DOE dealt with community leaders and interest groups only during crisis situations. They had not had time or sufficient contact to build knowledge about the specific interests of the groups involved. Nor had they had time to consider how to respond to those interests. They were called in to "fight fires" and did so with ad hoc policies. Sometimes these new policies were not communicated to operating staff until after conflicting policy statements had been made. The new policies were unaccompanied by guidance about how they should be implemented.

[16] Which they have done in abundance and with the expectation that additional information and educational forums would limit and satisfy opposition.

Finally, the ONWI siting program illustrates the tendency (predicted by hypothesis 3) toward long-term policy instability. The program for disposal in bedded or domed salt took its timing and scope from a presidential decision made during an election year. AEC was reorganized in 1975 into ERDA and NRC and then reorganized again in 1977 into DOE. While these reorganizations were not caused by political concern with the nuclear waste program, they in turn caused a reorganization within the waste program and did affect the continuity and coherence of the disposal effort. In addition, the members of the Michigan, Louisiana, Mississippi, and Utah congressional delegations or the state governors intervened in the federal program by introducing legislation or otherwise attempting to modify the programmatic thrust. Political officials have also intervened in the siting of private noxious facilities, for example, Governor John Spellman's recent decision to reject the Northern Tier Pipeline. While rejections of private facilities do not directly modify the decision process of private firms, interventions by these same officials in the nuclear waste area have frequently sought to directly modify federal policies and decision processes. Note the interest in Utah and other states to modify the siting criteria employed by DOE.

Concurrent with the ONWI efforts to locate a bedded-salt repository, three other potential waste repository sites were (and are) being explored. The three efforts are organizationally separate within DOE. [17] The first site, chronologically, explored after the failure of

[17] The separation results from organizational history, different sources of the waste, and different geologic media under study. See the next section for a detailed discussion of the organizational structure of the DOE waste program.

the Lyons effort, was near Carlsbad, New Mexico. Investigations began in late 1972. The Carlsbad project, known as the Waste Isolation Pilot Plant (WIPP), was first conceived as a repository to dispose of the wastes which resulted from the fire at Rocky Flats and for other defense wastes (less radioactive than HLW).

Observers seemed to feel that the long association of the state with the defense establishment and the atomic bomb made for acceptance of plans for the WIPP facility. (Smith, p. 114)

Until 1977, WIPP proceeded without much difficulty.[18]

In response to rapidly changing political pressures beginning in late 1976, WIPP was subject to several abrupt changes in definition. These changes seriously weakened DOE's credibility and illustrate the instability of the federal program for nuclear waste disposal. The first change occurred in 1977 when DOE announced that it was considering emplacing HLW at WIPP.[19] This action was in response to two stimuli. First was President Ford's message setting 1985 as the date for an operating repository. Political pressure was further enhanced as a result of the 1976 California statutes which banned the construction of additional nuclear reactors until a demonstrated technology for the disposal of wastes was available. This was the first time the construction of nuclear reactors (and potentially the continued

[18] The unexpected discovery of a large brine pocket in the salt resulted in relocation of the drilling site seven miles away to the current WIPP site.

[19] The change in purpose of the proposed repository also raised the issue of licensing by the NRC. NRC took the position that the new definition brought it within the scope of NRC licensing responsibility (but requested clarifying legislation from Congress). The DOE initially took the position that it should be outside the NRC's jurisdiction.

operation of existing reactors) was successfully tied to waste disposal. Other states were following California's example.

In February 1978, the federal policy changed again when a DOE task force recommended that a portion of WIPP be used for the disposal of 1000 commercial nuclear reactor spent-fuel assemblies and that the defense wastes be irretrievable. This recommended policy change was also in response to a presidential decision. In April 1977 President Carter announced that the United States would defer indefinitely all commercial reprocessing of spent reactor fuel. As a result, both ERDA and NRC had to consider spent fuel as a possible candidate for disposal. Necessary program changes put into further jeopardy the already optimistic 1985 goal for an operating repository.

The result was heated opposition in New Mexico. The two policy changes, coming close together and in conjunction with political events, further reduced the credibility of DOE officials. The state has significant defense-related nuclear activities and extensive uranium mining and milling but no commercial nuclear reactors. The prospect of disposal of spent fuel in the WIPP repository not only increased the potential radiation hazard but also raised the specter of the state becoming the nuclear "dumping ground" for the nation. In addition, the "test" facility was redefined as a full-scale repository--defense wastes would not be retrieved.[20] Again, the issue of state authority over federal waste disposal activities was raised.

In 1978 both the politics and the policy of WIPP unraveled rapidly. In January, the New Mexico House came within three votes of passing a constitutional amendment that would have banned the disposal of out-of-state nuclear waste; the

[20] Remember a similar change in policy resulted in insurmountable opposition in Lyons, Kansas.

potential changes in WIPP scope angered New Mexico's senators; and under pressure, Secretary of Energy James Schlesinger promised the New Mexico congressional delegation that the state would have veto rights over WIPP. (Smith, pp. 114-115)

In 1978, the DOE held a series of public hearings in New Mexico at which DOE defended its position, reiterated the guarantee of a veto, and stated its intention to seek licensing review from the NRC. The issues raised during the hearings included all five sources of conflict outlined in Chap. 2: (1) distributive issues such as why New Mexico should accept the nation's wastes and the need for compensation for negative impacts; (2) varying levels of acceptable risk such as whether the standards for risk from transportation were acceptable; (3) differences in technical judgment such as the geologic suitability of salt as a disposal medium; (4) distrust of DOE especially as a result of the sudden policy shifts; and (5) conflict of objectives highlighted by those groups who opposed waste management as a means to oppose nuclear power. The DOE responded by (1) publishing transcripts of the proceedings, (2) providing substantial funds[21] to the state to review DOE site characterization efforts, and (3) working to develop procedures for state consultation in the DOE process.

The promises of a veto and NRC licensing review were successfully challenged by the House Armed Services Committee. In June 1978, House Armed Services Committee Chairman Melvin Price blocked the use of DOE and NRC funds for the licensing of WIPP. Eventually Congress passed legislation which limited WIPP to disposal of non-HLW defense wastes and reaffirmed the prohibition of NRC licensing. In additional legislation, the 1979 DOE military authorization bill refused to grant the state veto

[21] Several million dollars over a six-year period.

rights. Instead, language was inserted which gave New Mexico the right to "consult and cooperate" with the DOE.

Concurrent with this congressional debate, an Interagency Review Group on Nuclear Waste Management (IRG), appointed by President Carter to consider the recommendations of the DOE task force, was engaged in an internal debate about the benefits of continuing the WIPP project. The IRG[22] recommended (with DOE dissenting) that WIPP be terminated.[23] In October 1979, President Carter accepted the recommendation to terminate WIPP. Secretary Duncan unsuccessfully appealed Carter's decision. DOE announced that WIPP was terminated in January 1980. This did not end work at WIPP. The congressional authorization still called for WIPP to be used as a repository for defense wastes. Despite the President's decision, DOE work continued at the site. In January 1981, as President Carter was leaving office, DOE formally announced that WIPP would be developed as a repository for defense wastes. Immediate protests and legal challenges came from the state.[24] In addition, the BLM argued that the DOE decision was not adequately supported. Under the Reagan Administration, work continues at WIPP.

In 1982, the DOE hit another brine pocket at the WIPP site. The eventual outcome is uncertain. The WIPP experience provides additional evidence that DOE relies on procedural regularity to justify action and

[22] Members included the DOE, Department of State, DOI, Department of Transportation, Department of Commerce, National Aeronautics and Space Administration, Arms Control and Disarmament Agency, EPA, OMB, CEQ, OSTP, Office of Domestic Affairs and Policy, National Security Council, and NRC.

[23] In another action, the IRG officially abandoned the 1985 date for an operating repository in favor of an objective sometime in the mid-1990s.

[24] The challenges are still pending.

to respond to opposition and that political appointees retain authority to respond to political constituencies.

The WIPP experience graphically illustrates the instability of the DOE program in response to short-term political agendas (hypothesis 3). DOE officials (at the appointed or career level) are unable to make binding commitments to state officials or other constituency groups. Their commitments to seek NRC licensing and to allow a state veto were both overruled by the Congress.[25] The program scope and national policy were changed abruptly by presidential decisions and presidential appointees in response to larger political goals or pressures. The inability to make commitments and the changes in program scope seriously hinder the credibility of the DOE officials and undermine trust in their capabilities and in their technical judgments. The resulting lack of trust has been and continues to be the source of powerful opposition.

Two additional potential sites are being investigated. One is at the Nevada Test Site, a large land area already controlled by the DOE and used primarily for nuclear weapons testing. The second is on the Hanford Reservation in Washington state, also a DOE site committed to nuclear weapons activities. The current investigations began at both sites in 1977. The exploration of sites at these two locations satisfies a requirement imposed by the NRC that DOE consider geologic media other than salt for disposal of HLW. (Tuffaceous rock (or tuff) is the candidate geologic disposal medium at Nevada, and basalt is the geologic medium at Hanford.) Because these candidate disposal sites are on land already in the custodianship of DOE, it has been possible for

[25] While these commitments were ad hoc responses to crisis situations, they were made in good faith and in the belief that they would eliminate sufficient opposition to allow investigations to continue.

many activities to proceed without the need for approval of outside actors. For example, DOE did not need to acquire mineral leases, drilling rights, or drilling permits. As indicated, these activities were organizationally separate from the siting activities described above. The two site investigations are conducted by DOE Field Offices which were already in existence and had long conducted nuclear activities. As part of their historic duties, they had interacted with local leaders and interest groups.

By early 1980, little external opposition had surfaced. Some observers believed that this resulted from the familiarity of the local populace with nuclear activities and the support of important political leaders. For example, the Hanford reservation is located near the Tri-Cities (of Richland, Kennewick, and Pasco), a local community that is accustomed to living near nuclear-related projects and is heavily dependent on the economic benefits of Hanford. The region was represented in the House of Representatives until 1981 by Mike McCormack who was a nuclear scientist, a former employee at Hanford, and perhaps, the leading advocate of nuclear energy in the House. Dixy Lee Ray, the Governor of Washington until 1981, was also an advocate of nuclear energy and a former Commissioner and Chairman of the AEC. In addition, the directors of the Richland and Nevada Field Offices attributed the lack of opposition primarily to the presence these officials have established in their respective states and the long-term relationships and trust which have developed as a result of repeated interaction.

Opposition has strengthened in both states since 1980. While the Program Offices have maintained procedures for and traditional styles of interaction with their respective states, the politics of the two states

have changed substantially. Both states have experienced leakage and other difficulties in transportation of low-level radioactive wastes (LLW) to established disposal grounds in those states. Nevada has also experienced operational problems with its LLW burial ground. Concern has increased in Nevada regarding health effects from exposure to radiation from atomic tests during the 1950s. This concern is exacerbated by the denial by DOE of adverse effects and of responsibility. Finally, with the defeat of McCormick and Ray in 1980, the political leadership of Washington is far less tolerant or supportive than it used to be of nuclear development in the state. The issue of state veto or control authority has arisen in both states, and the state legislatures have voiced substantial interest in and concern over the DOE site investigation activities. DOE has responded with agreements of cooperation in both states.

Thus, the DOE investigations in nonsalt media provide evidence which further corroborates hypothesis 1.

ORGANIZATIONAL STRUCTURE AND DELEGATION OF AUTHORITY

The DOE program for HLW disposal is contained within a complex waste management organization reporting to the Assistant Secretary for Nuclear Energy. The entire organization under that assistant secretary is shown in Fig. 2. All waste management activities are conducted by the Office of Terminal Waste Disposal and Remedial Action. That office has four major divisions (see Fig. 3). Responsibility for site development, as well as all technical research and development activities, are within the Division of Waste Repository Deployment. The FY82 program funding is \$188 million.

Figure 2

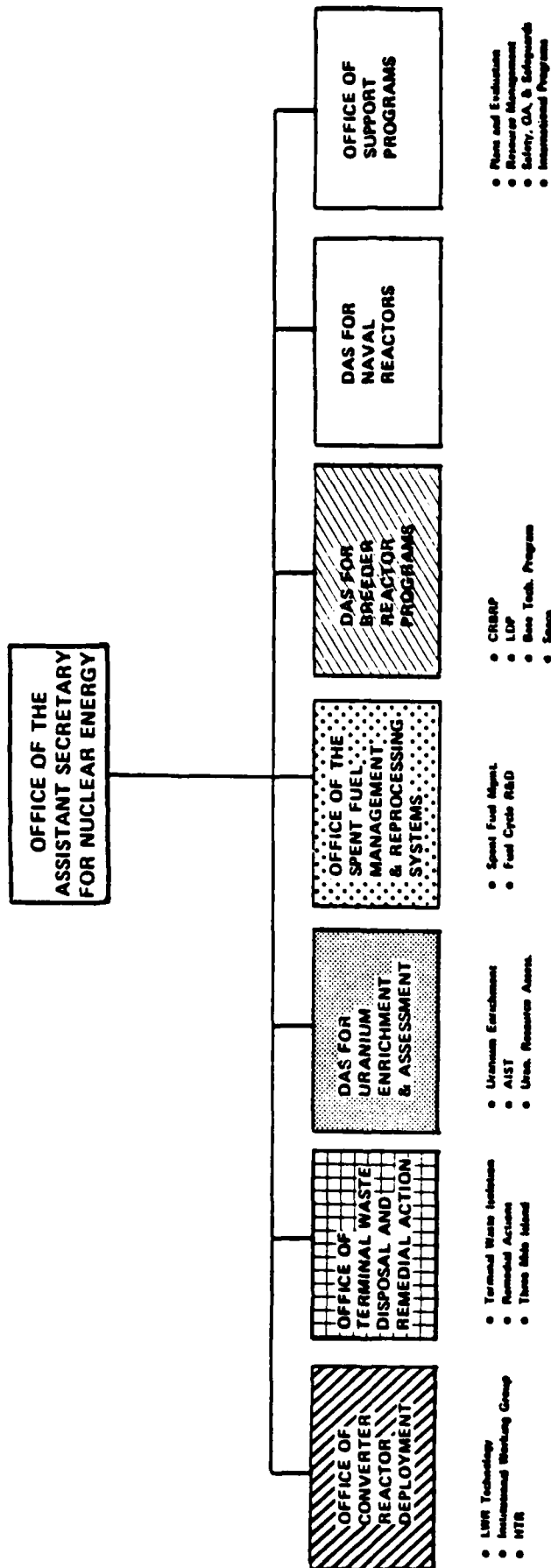
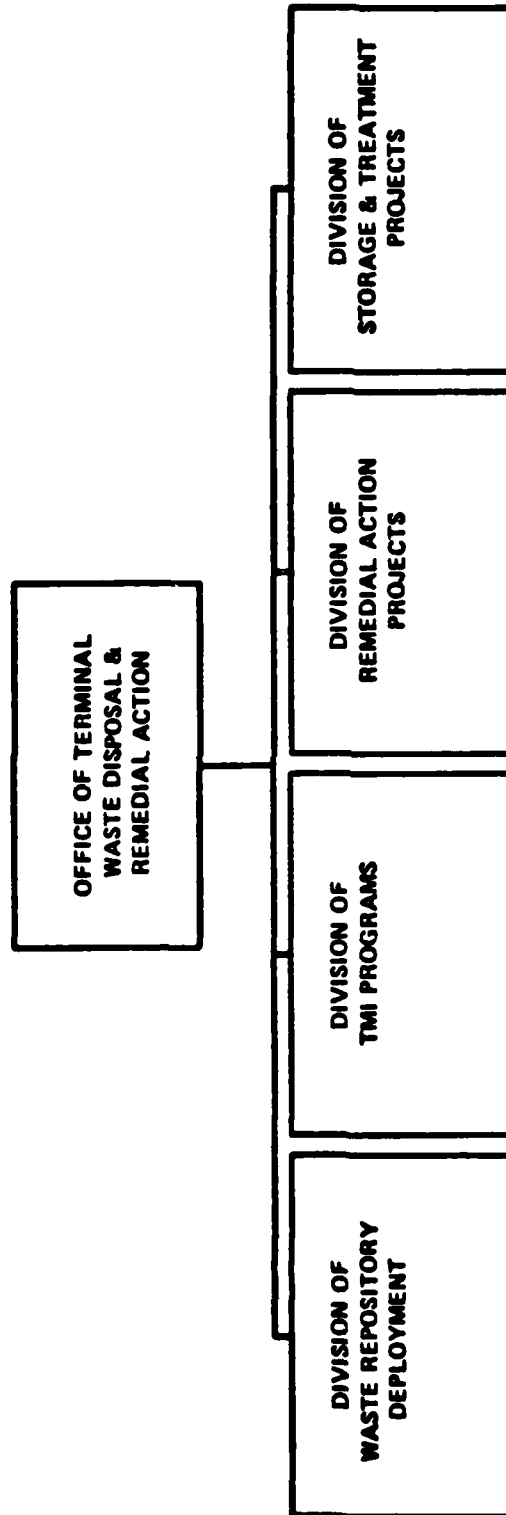


Figure 3



Authority to deal with distributive, equity, intergovernmental, and other political issues is centralized at a high level in DOE headquarters. According to program documentation,[26] the Director, Office of Terminal Waste Disposal and Remedial Action retains for himself responsibility for:

1. Directing the "planning, development and implementation" for disposal of commercial HLW;
2. Coordinating public, foreign, GAO, congressional, and other interagency activities;
3. Coordinating program activities with state and local governments as required and in accordance with overall DOE policies and procedures; and
4. Implementing DOE national policies on environmental matters.

These responsibilities are not delegated to operating officials with responsibility for site investigation and development. According to discussions with a DOE official, this division of responsibility is in response to the policy-setting and distributive nature of the issues raised by outside groups.

Technical and logistic responsibilities are delegated to the Division of Terminal Waste Disposal and Remedial Action. Among other duties, the Division is responsible for:

1. Directing and coordinating the program to develop, design, license, and operate mined geologic repositories for commercial nuclear waste;

[26] Documentation provided by a DOE waste management official regarding a new organizational structure effective May 1982.

2. Plan, oversee, and evaluate activities to characterize potential repository sites, excavate exploratory shafts, and perform related NEPA functions;
3. Plan, oversee, and evaluate R&D activities; and
4. Coordinate activities with other DOE offices responsible for transport of waste to repositories.

At present, responsibility for disposal of defense wastes is not under the Assistant Secretary for Nuclear Energy. Under the Carter Administration, responsibility for commercial and defense wastes rested in the same organizational unit. The Reagan Administration reversed this organizational concept. Complexity and confusion between commercial and defense wastes have always existed. Complexity results, in large measure, from the congressional appropriations and authorization process in which separate committees have budget authority over defense and commercial activities. Complexity also results from traditional separation of these activities in the DOE and predecessor agencies and can be traced to the incremental way in which the program was assigned new responsibilities. Thus, the WIPP project once reporting to the Assistant Secretary for Nuclear Energy now reports to the Assistant Secretary for Defense Programs. There is now a strong organizational separation between the operating officials responsible for site development of commercial and defense repositories.[27]

The technical and operational portions of the DOE waste disposal program are highly decentralized. Three major DOE field organizations

[27] For example, there are no formal mechanisms for coordination at the operating levels.

administer and execute the program--the Columbus Program Office, the Richland Operations Office, and the Nevada Operations Office. The Columbus Office is responsible for the search for a site in salt; the Richland Office for the investigations in basalt at Hanford; and the Nevada Office for the work at the Nevada Test Site. A small headquarters staff (less than 30 professionals including the Office of the Director) supervises and coordinates the activities. Under decentralization, headquarters personnel are responsible for "development of overall plans, establishment of priorities, and analysis of program requirements." [28] The accomplishment of given technical program objectives rests with the Field. Field organizations contract for the work to be performed; the primary responsibility of the field staff is to direct and evaluate the prime contractors. The primary contractor for the Columbus Office is the Battelle Memorial Institute; Rockwell is the contractor for Richland; and Nevada directs the efforts of four contractors. In 1980, 14 people in the Columbus Office directed Battelle's efforts at a funding level of \$100.6 million; six people in Richland directed Rockwell's efforts at a funding level of \$33.3 million; and six people at Nevada directed four contractors at a funding level of \$21.4 million. In addition to performing field tests, research on waste form, and other technical components, DOE contracts out the technical coordination of diverse waste isolation activities. The current contract for coordination is funded at a level of more than \$3 million per year.

[28] Statement of Position of the United States Department of Energy, in the Matter of Proposed Rulemaking on the Storage and Disposal of Nuclear Waste, April 15, 1980, p. III-3.

This highly decentralized organizational structure where small staffs plan and direct the expenditure of large sums of contract dollars is not unique to the waste management program. DOE as an organization has committed to this structure to facilitate the research and development functions for which it is responsible. The national laboratories which perform research and development and technical assistance for the Department are directly associated with DOE Field Offices and have over the years developed significant expertise for various tasks. The reliance on national laboratories and contractors also results from the tendency of the Congress and the OMB to increase contractual support for new and expanding programs without corresponding increases in staffing levels.

Each of the project offices has a separate charter or management agreement which formally delegates responsibility and is signed by a deputy assistant secretary^[29] and by the program managers in the Field. Although each of the agreements is somewhat different, many elements are similar. In all cases, the Field Office is charged with project administration, and headquarters is charged with overall project monitoring, guidance, and approval. Tables 4 and 5 array the delegated and reserved authorities, respectively, for each Field organization. For purposes of this study, the significant differences in delegated authorities involve:

[29] The current charters were signed by the Deputy Assistant Secretary for Nuclear Waste Management, a position abolished by the Reagan Administration.

Table 4

FIELD AUTHORITIES

Responsibility	Nevada	Richland (BWIP)	Columbus (NMTS)
Prepare an annual Project Plan which incorporates headquarter guidance outlining the work to be performed, resources required to perform this work, and the scheduled performance	x	x	x
Administer DOE program responsibilities	x	x	x
Contract Administration	x	x	x
Review and consolidate budgets and performance schedules	x	x	x
Approve changes to designs, schedules, funding allocations, and commitments to completion dates	x	x	x
Develop and implement a control system to evaluate costs, performance schedule, and technical performance of the contractors	x	x	x
Maintain technical overview of Project activities via periodic meetings, reviews, Project reports, and other means to assure that the Project objectives are being effectively met	x		x
Review and approve the designs of surface and underground facilities, and waste handling equipment to meet the programmatic objectives of the Project	x	x	x
Assure that plans contain the requirement to implement the appropriate DOE-approved procedures for safety, security, and maintenance	x		
Establish a quality assurance plan and insure proper implementation by all Project participants	x	x	
Ensure preparation of environmental assessments		x	x
Provide technical and administrative assistance to headquarters			x
Establish advisory groups or arrange for the services of consultants as appropriate	x	x	x
Provide support in the preparation and implementation of a Public Affairs Plan	x		
Interact with the NRC on licensing requirements with the concurrence of headquarters	x		
Conduct interactions with other government agencies, state and federal, after coordination w/headquarters	*	*	
Purchase (or condemn) leases to protect integrity of site	N/A	N/A	

* These activities are neither delegated to the Field nor reserved by Headquarters.

Table 5

HEADQUARTERS RESERVED AUTHORITIES

Responsibility	Nevada	Richland (BWIP)	Columbus (NwTS)
Establish and provide overall policy and program guidance	x	x	x
Monitor the performance of field office and contractors and provide direction and guidance as appropriate		x	x
Review program goals proposed by field and contractor; concur in and provide final approval of an integrated program plan for meeting those goals, including changes thereto	x	x	x
Approve major program and facility initiatives	x*	x	x
Approve general site, facility, and waste form criteria	x	x	x
Approve overall licensing, planning, and strategy for major waste facilities		x	x
Maintain cognizance of executive, legislative, and regulatory policies and advise field of such policies	x		x
Coordinate all public affairs and state interactions			x
Liaison at national level	N/A	N/A	x
Review and approve environmental and safety documents	x	x	
Resolve differences among field organizations			
Approve budget levels	(x)	(x)	(x)

*The Management Charter for Nevada lists only the following specific major initiatives: utilization of spent reactor fuel, selection of AE and operating contractors, decision to start construction, test operations and start production phases.

**The Management Charter for WIPP lists similar major initiatives as does the Nevada Charter.

(x) = reserved authority implied.

- interaction with state and local governments,
- interaction with nongovernmental parties,
- legislative analysis, and
- approval of major program initiatives.

According to formal delegations of responsibility, the Nevada and Richland Field organizations have far broader authority to act in these areas than does the Columbus program. Major elements important to implementing the siting process such as state and local policy initiatives, legislative analysis, and approval of program initiatives appear to be withheld from Columbus but not from the other Field organizations. This can be attributed in part to the broader (multi-site) and more complex scope of the Columbus program and to the long-established coordination and interaction among the Nevada and Richland Field Offices and their respective host states. Since the Nevada and Richland activities are fully contained within the host state, detailed knowledge about local attitudes, interests, and leaders is developed and can be used to facilitate site investigation activities. We saw in the preceding section that, prior to 1980, less opposition had developed in Nevada and Washington than in other states. The project managers believe that this is a direct result of their detailed knowledge about and established presence in the state and local communities.[30]

The program charters reflect only formal guidance. Informal guidance is also a factor in analyzing delegations of authority. Discussions were held with responsible headquarters and Field officials to try to understand the informal delegations.[31] These discussions

[30] While the increase in opposition following political changes in the states seems to dispute this belief, this research does not evaluate the influence of the Field Offices.

[31] These interviews were conducted in 1980 as part of a previous

verified for the most part the formal delegations with two important exceptions:

1. The Columbus organization undertakes significant interaction with other federal agencies and with state officials. Activities with states are limited to (1) education programs and technical information exchange and (2) development of procedures for coordination consistent with established agency policy. These activities are always coordinated with headquarters but usually not conducted by headquarters.
2. The Nevada and Richland Field Offices are powerful organizations which have gained their power over a long tradition of semi-autonomy from headquarters. They have a lot of freedom to initiate or conduct interactions and establish institutional arrangements regarding on-going activities. The Columbus Office, which is relatively new and was established to conduct the site investigations in salt, has acquired less power, autonomy, and freedom of action.

Notwithstanding the power and autonomy of the Nevada and Richland Offices, the operating officials of all Field Offices and of DOE headquarters have prime responsibility only for standard research, development, and operational activities such as developing geologic analytic models or engineering test facilities. This assignment of responsibility is clear and has resulted in detailed program efforts to conduct such activities.

study by this author, the results of which are reported in Institutional Issues in the Planning and Implementation of a Program to Dispose of High-Level Radioactive Wastes, N-1650-DOE, February 1981.

Formal and informal responsibility is retained at the very top level of headquarters management for overcoming external opposition. As a result, operating staff have no incentives to gather information about opposition or to develop the skills to anticipate opposition or to propose methods or responses which will limit or resolve conflict. The lack of analysis and anticipation at operating levels, in turn, results in ad hoc policies being developed by political superiors in response to crisis situations. The case-by-case approach to setting policy has resulted in inconsistent policies as was seen in the previous section. It has also led to unanticipated, and potentially undesirable, policy outcomes. The pattern of delegation described here provides further evidence in support of hypothesis 1 which predicts an inflexible DOE response at the operating level to external opposition.[32]

Equally important to the flexibility of an executive agency is the existence of statutory authority sufficient to respond to policy and distributive issues raised by opposition. DOE is severely hampered, if not rendered incapable of siting repositories, because it lacks important statutory authority.[33] Executive agencies cannot take action unless legally authorized.[34] This is one of the most important

[32] Moreover, as was illustrated in the previous section, the federal policy response, while extraordinarily flexible (unstable), was too crude to be responsive to the specific issues arousing opposition.

[33] This was the conclusion of the previous report, N-1650.

[34] For example, the DOE FY80-FY84 multiple-year plan for commercial waste management was based on specific legislative mandates to take particular actions; DOE did not plan for activities where explicit authority did not exist. See the "Commercial Waste Management Multi-Year Program, FY-1980" which states (p. 48) that legislation recommended by the IRG but not yet passed by Congress is not included in the plan. It then lists the areas of potential new legislation.

distinctions made in Chap. 3 between private sector organizations and executive agencies. Statutory authority does not appear sufficient to respond to equity and distributive issues or to differences in acceptable risk. In addition, authorizing and/or appropriations legislation will be needed for specific tasks such as land acquisition and construction. DOE has recognized the desirability of being able to offer economic incentives to host communities. But Chap. 3 suggests that political actors will retain the authority to distribute benefits from repository development and, therefore, additional statutory authority will be difficult to achieve.

THE SITING PROCESS

The need for a HLW repository is established by federal law and regulation. It is taken as a given by the operating and upper-management staff at DOE. Moreover, we have seen that the definition of the repository (e.g., what wastes will be disposed, where it will be located, and the number of facilities) comes largely through the political process. The project definition is unstable, poorly articulated, and often internally inconsistent. The DOE staff is unable to redirect the repository program or to stabilize the project definition.

DOE documentation describes the current siting process as including three phases:[35]

[35] The description of the current siting process is primarily based on two submittals to the NRC by DOE that provide evidence of DOE's confidence that the DOE program will result in timely establishment of HLW repositories. The two submittals are part of the NRC "waste-confidence rulemaking." The rulemaking stems from a 1976 petition by the National Resources Defense Council calling for NRC to hold a rulemaking on whether it should stop issuing operating licenses until it is confident that wastes will be safely disposed of. NRC

1. site exploration;
2. detailed site characterization; and
3. site selection.

The site exploration phase represents the spatial locational analysis described in Chap. 2. First a region of interest is identified, then specific sites are evaluated. Unlike the process described in Chap. 2, the factors leading to the identification of regions and alternative sites relate to the geologic characteristics and not to factors such as transportation cost or proximity to markets. As indicated in the section on siting experience, several alternative locations have been identified including salt domes in Louisiana and Mississippi, a bedded-salt site in Utah, tuff on the Nevada Test Site, and basalt formations on the Hanford Reservation.

Detailed characterization refers to the extensive geologic and technical information required to design a repository for the specific site and to file the detailed license application which is required by the NRC. The characterization process will probably require the sinking of exploratory shafts and therefore could take as long as four years.

Selection among candidate sites is the next step. Consideration of multiple sites is required according to NRC proposed regulations. The DOE states that a comparison of "environmental factors and technical aspects" will be made but does not indicate the specific criteria on which the choice will be based.

denied the petition. It was remanded by the U.S. Court of Appeals for the District of Columbia Circuit which told NRC it must reconsider the issue. The two submittals are DOE/NE-0007, April 1980, and DOE/NE-0007, Supp. 1, September 1980. The second filing is a cross-statement in response to initial statements of other parties to the rulemaking.

In addition to the technical considerations, siting criteria published by ONWI (ONWI-33(2)) include:

- land-use conflicts--sites on protected lands (such as National Park Service Lands) will be considered but the site evaluation will consider "whether mitigating measures could be undertaken to allow repository construction and operation" (ONWI-33(2))
- transportation--ability to upgrade or construct adequate[36] roadways
- socioeconomic impacts--ability to mitigate negative impacts

Evaluation of land-use conflicts, transportation requirements, and socioeconomic impact mitigation, as these factors are defined by ONWI, require detailed investigation. The DOE will not exclude sites based on nongeologic criteria[37] but instead will try to measure and mitigate adverse impacts. Institutional factors, therefore, are considered only after a tentative location decision is made public and after opposition has mobilized.

DOE monitoring of the external institutional environment has not changed from the mechanisms used in the bedded salt investigations described in the earlier section. The information programs and use of public hearings and meetings have increased in size and number. As described in Chap. 3, these are formal procedures. They have often

[36] Adequacy, in the context of the ONWI criteria, refers to technical adequacy (e.g., whether roads exist and are of sufficient quality to handle the weight and frequency of waste transport). It does not consider adequacy to overcome or limit opposition.

[37] That is, it will not publish decision rules which exclude sites (or justify exclusion) based on institutional or political factors.

polarized issues rather than provided mechanisms to understand the interests of other parties and to negotiate solutions.

While there is ample recognition by DOE officials of the different sources of conflict, the program is not designed to anticipate or identify potential or actual conflict. Opposition, when it arises, is met through the establishment of procedures to guide, communicate, and justify agency actions. DOE is responding to differences in technical judgment, different levels of acceptable risk and uncertainty, and credibility issues through the use of public education programs and other communication programs. This reaction stems, in part, from the lack of recognition that there exist legitimate value differences and, instead, the sincere belief that with more complete information, opponents will accept DOE judgments. These programs are designed to communicate the agency's thinking and objective information about repository risks.

The DOE program to consider "socioeconomic impacts" again stresses procedures. "Principal components" are listed as follows:

1. Studying the nature of the problem ... and possible mitigation measures, and compensatory and incentive (procedures).
2. Designing of a community development program to involve site areas in the planning and development of siting arrangement and impact mitigation....
4. Actively soliciting expertise of other Federal agencies through cooperation on resolution of issues. (DOE/NE-0007, Supp. 1, p. II-56)

DOE is particularly concerned with potential opposition from state governments. In response, the concept of "consultation and concurrence" was developed by the IRG and adopted by President Carter and DOE. The

work to date has involved developing procedures for consultation. For example, DOE/NE-0007, Supp. 1 shows at what points it will provide information to states, the probable nature of that information, and at what points it will seek concurrence from the state. No attention has formally been paid to the sources of opposition which are likely or to specific compromises, concessions, or side-payments which might respond to specific opposition. "Conflict resolution mechanisms" are defined to include third-party decisions such as by the NRC, the President, or Congress.

The procedural avenues and information which are made available to opponents because this is a federal decision are important and numerous. The choice will be the subject of a detailed license application to the NRC. The NRC will hold public hearings on the application at which time the DOE will have to defend the technical suitability of the chosen site. During the course of obtaining other permits and approvals, the decision will be the subject of hearings by other federal, state, and local agencies. But the need to gain formal approvals does not differentiate the demands placed on DOE from the demands which would be placed on private entities.[38]

In addition, DOE must defend its decision as part of its own requirements which assure accountability to the public. For example, DOE is required (pursuant to recommendations made by the IRG and accepted by President Carter) to develop a plan which describes the entire program leading to repository operation, including the ongoing research, the site characterization process, transportation planning, facility engineering, and interaction with other agencies and with the

[38] This is not to say that these procedural avenues are not sufficient for committed opponents to halt construction of a repository.

states and public. This plan and the rationale behind the plan, must then be defended in public hearings and in response to written questions and criticism. The requirement to describe the entire program and to defend it in the abstract provides avenues for opposition in addition to the avenues available during the formal siting process. Second, as part of an environmental assessment pursuant to NEPA, DOE must defend the reasons for the selection of one site over alternative sites. During the course of its own hearings and those of other agencies, information not required of private entities, such as the existence and nature of formal dissenting opinions and to whom the agency officials talked and the content of those communications, is available to those who oppose the agency's decision.

During these hearings and before congressional committees, DOE will be called upon to demonstrate that its choice conforms to diverse and incommensurable nontechnical criteria. For example, those individuals or groups who are concerned about land use, proximity to population centers, and emergency response capabilities can directly challenge DOE on these issues without considering how they are balanced against each other or against safety criteria. A single, overarching objective does not exist for the siting and development of HLW repositories. While protection of public health and safety could be described as such an objective, the EPA has not yet published standards for allowable emissions from a repository.

Even if the question of "how safe is safe enough" could be answered, the DOE must publicly answer demands placed on it to develop repositories which minimize and compensate for negative impacts and which distribute the risks of transportation and disposal of wastes

equitably across the nation. Answering the demand of one constituency group is likely to raise competing and mutually inconsistent demands from other groups. For example, some groups want multiple repositories developed as a way of insuring the ability to relocate wastes if unexpected technical problems arise and as a way of distributing the responsibility and risk of waste disposal. On the other hand, the nuclear industry and utilities are interested in rapid demonstration of safe disposal and do not want to suffer the delay of identifying multiple acceptable sites. Either decision by the DOE will be challenged through avenues mentioned above. In a rather different example, if side-payments are made to the host community, other groups will be mobilized in opposition. Side-payments from executive agencies (rather than from Congress) raise the public concerns that the DOE is not acting in an ethical manner, and they bring into question the safety of the repository. That is, side-payments can be viewed by the host community as a bribe which is required because the repository cannot be made safe enough to protect public health. Similarly, it is difficult for an executive agency to justify or develop decision rules for reducing transportation risks to the host community by upgrading the package standards, beyond those required by law, or by constructing new roadways.

This section, then, provides some evidence in support of hypothesis 2. DOE's ability to balance competing objectives is hampered by the (1) reliance on decision rules, (2) existence of noncommensurable goals, and (3) multiple avenues of access to political officials by diverse constituencies.

The case as a whole portrays DOE program officials who have tried, within statutory authority and standard procedures, to accommodate the variety of opponents and interests. They have held numerous meetings to explain the program in the sincere belief that it is in the public interest. The efforts of these officials have been stymied by the institutional constraints and specific mechanisms for accountability that society places on public officials and programs. The flexibility of the DOE's program and ability to respond to different sources of conflict is limited by (1) restricted mechanisms and incentives for collecting data and information, (2) the reliance on decision rules and procedural regularity because of a need to justify action, (3) retention of authority by political appointees for responding to distributive and political issues and differences in values, and (4) lack of statutory authority to offer compensation for impacts which cannot be objectively measured. The program is so complex that even without obstacles it would span several administrations. Long-term program stability is threatened by the need felt by political actors to show results in the short term and to respond to the pressure of constituencies. Thus, major programmatic changes are made as a result of intervention by the President and Congress and in response to political promises and pressures. The resulting policy changes and broken promises have seriously undermined the credibility of the DOE efforts.

VI. AN OIL COMPANY PROGRAM FOR SITING PETROCHEMICAL FACILITIES

The company examined is one of the leading domestic integrated oil companies with a strong position in petrochemicals.[1] It also produces a certain amount of coal, is developing other mineable coal and geothermal steam reserves, and is investigating other energy sources such as tar sands, solar energy, and synthetic fuels. In 1980, oil and gas exploration and production accounted for about 75 percent of profits; oil products less than 20 percent; and chemical products less than 10 percent.

A major oil company was chosen for the private sector case because (1) its size (number of employees) is at least as large as the DOE or other major executive agency plus prime contractors, (2) its organizational complexity and diversity of activities is not unlike a major executive agency, (3) the facilities sited and developed by oil companies (e.g., oil refineries, petrochemical complexes, and LNG terminals) are often considered hazardous and undesirable by local residents, and (4) oil companies, like the DOE, have had troubles with public credibility and trust during the 1970s. The particular company was chosen because of its willingness to participate in detailed and lengthy interviews at the company headquarters.

The purpose of this chapter is to describe the evolution of the company's process for siting petrochemical facilities from approximately the late 1960s through present. Today, the process for siting and

[1] While the detail contained in the case will probably identify the company to an individual familiar with the oil industry, the company's identity is unimportant to the research and will not be used.

developing new capital facilities is a highly iterative and sophisticated balancing of technical, economic, and institutional factors. In the 1960s, the siting process was highly linear. The siting process has evolved (a) in response to changing external conditions and lessons learned from past successes and failures and (b) as a result of changes in management organization and practices which were independent of the siting experience.

The structure for evaluation is the same as that used in the preceding chapter. The first section examines the siting experiences of the company--the sites explored, the reasons for those choices, the nature of opposition, and response to opposition. The description considers the flexibility of the company to respond to external opposition (hypothesis 1) as a function of (a) changes in standard procedures and (b) the pattern of authority to deal with opposition. The second section analyzes the formal and information organizational structure, delegation of authority, and lines of communication. This contributes further evidence to corroborate hypothesis 1 by examining the delegation of authority to line officials and whether lines of reporting and communication encourage deviation from standard procedures when new circumstances arise. The description also examines the stability of program goals and policies over the 12-year period (hypothesis 3). The third section takes a static photograph of the current siting process. It contributes to the test of hypothesis 2 by examining the ability of the company to balance competing objectives and to respond to competing demands in arriving at siting decisions. It also adds insight to the company's mechanisms for monitoring the external environment (hypothesis 1).

Except where otherwise stated, the descriptive material was developed on the basis of interviews held in February 1982 with line officials. Problems of accuracy and perspective are well recognized in the case-study approach. To lessen such difficulties, 11 executives closely associated with the siting process and its historical development were interviewed. Viewpoints and statements were cross-checked wherever possible, and internal documentation was examined on-site. The entire case has been reviewed by an appropriate corporate authority for accuracy.

Of course, it should be remembered that siting and facility development are integrated elements of the corporate decisionmaking structure. It is very difficult to separate these activities from other corporate activities. In so doing, this case study necessarily simplifies and may seem to overemphasize institutional factors in the facility development process.

SITING EXPERIENCE

The company's siting experience, like that of many other major oil companies and the DOE, is sparse.[2] It sites approximately one major facility[3] every 20 years and one to three minor facilities every five years. Other additions to capacity are accomplished by expansions of existing facilities or complexes.

[2] The comparison of this company's siting frequency with other petrochemical companies is based on telephone conversations with representatives of approximately 10 companies during the course of the research.

[3] A major facility represents a capital investment of greater than \$100 million.

External opposition started to affect seriously the company's ability to conduct business in the late 1960s. By the mid- to late-1970s, the anticipation and resolution of such opposition had become fairly routine activities. Prior to the late-1960s, several chemical facilities were sited without problem. For example, three chemical plants, one each in Ohio, New Jersey, and Alabama were routinely sited and built in the mid- to late-1960s. A pesticide formulation plant was sited and built in Illinois in the early-1970s. But from the 1960s through the mid-1970s, three separate attempts to site an east coast refinery failed. The first and third tries were stymied by events beyond the control and reasonable anticipation of the company. In the other case, unanticipated community and environmental activism rendered a technically and economically feasible project politically infeasible.

The company was interested in establishing an east coast refinery in order to expand the company's east coast market. A first site was abandoned when a turnpike was scheduled to be built through the property. After the false start, a contractor was hired as a "blind" consultant to recommend a site which would be technically and economically suitable. That is, the contractor acted in the company's interest but under its own name. The company's name was not made known publicly until legally necessary. Secrecy was considered important in order to gain competitive advantage. Upon the contractor's recommendation, sufficient options were collected on a mid-Atlantic farmland site to build a refinery and to create a 3000-acre buffer around the site which would reduce visual, noise, and air pollution impacts on the surrounding community.[4] The necessary zoning changes

[4] The strategy of creating a buffer zone had been used

(from agricultural to industrial) were obtained, and the options were exercised in the early 1970s.

Unexpected public opposition was met. The recollection and understanding of the opposition (now more than 10 years past) differed substantially among those interviewed. One explanation came from a location manager who was brought in to play the role of "credibility man" or management spokesman.[5] He enumerated the issues as (a) recognition by state and local politicians that environmental advocacy was a political asset, (b) existing oil refineries (and a powerplant) which were quite dirty, smelly, and visually undesirable, and (c) a tax structure which relied primarily on income tax rather than property tax.[6] A second official, currently managing a line environmental unit, also recognized a legitimate environmental concern over wetlands situated on the buffer around the proposed site.

The first task in responding to the unexpected opposition was to understand its source and to figure out what to do. To do this the liaison official spent approximately two days every other week at the proposed location. Meetings were arranged with local community leaders (e.g., labor leaders), the appropriate corporate vice president was brought in to continue conversations, and a local law firm was employed to perform liaison functions. Nonetheless, the concern over the

successfully by the company to gain community approval for another refinery and was expected to be sufficient in this instance.

[5] The role played was to communicate the position of the company and to persuade the local community of the benefits of the proposed plant. It was largely a liaison role.

[6] A refinery might be expected to have a significant impact with regard to quality of life since historically refineries were smelly and dirty; but as a capital-intensive project, it would contribute little in the way of taxes or employment.

wetlands was not resolved. Local interests were concerned that since the land was owned by the company, it might eventually expand into the buffer area thereby threatening the wetlands. The citizen group advocated a transfer of the wetlands out of the company's ownership. The company, wanting the land as a buffer, would not agree to that condition. Releasing the land would eliminate any buffer and, it was feared, the community might then be in a position to exercise greater control over actual operations. The governor took up the issue by introducing a bill establishing a coastal zone area[7] which would encompass the proposed site. A final appeal was made directly by the president of the company to the governor. It was unsuccessful. The company withdrew its proposal rather than fight in the political arena to gain approval.[8]

Still intent upon expanding its east coast market, the company turned to another site which had been recommended by a contractor. This time the contractor was instructed to consider environmental and political feasibility in addition to economic and technical desirability. The company wanted to avoid coming up against environmental opposition again. To assure that environmental contingencies were properly accounted for, the company spent 15 months and more than \$1 million to prepare an environmental assessment of the potential impacts. This assessment was not required by law. It was

[7] The Coastal Zone Management Act of 1972, as amended, establishes a statutory scheme, under which states are encouraged, with federal assistance, to develop and implement coastal zone management programs which will achieve wise use of the land and water resources. Under a provision of the Act, federal agencies are generally required to conduct their programs and approvals in a manner consistent with state coastal management programs.

[8] The company retains the undeveloped property.

coordinated with the state environmental agency, and a scientist recommended by the head of the state environmental agency was included on the team performing the assessment. The 1973 oil embargo was put into effect by the Organization of Petroleum Exporting Countries while the company was still in the process of acquiring necessary construction permits. The embargo and subsequent oil import quotas made the construction of a new refinery economically infeasible. The project was aborted. The company redefined its corporate goals to exclude expanding its east coast market, abandoned efforts to build a refinery, and has not tried to construct a new refinery since that time.[9]

In the next siting episode, the company decided to open a major "green field"[10] chemical production complex. In order to draw on corporate and personal experience, the same individual who had acted as management spokesman previously was brought in to coordinate the siting and development process in this instance. The time was the early 1970s. The company was experiencing rapid growth in chemical sales. Existing facilities were nearing capacity, and planned expansions at existing sites were expected to fully utilize available work forces. Thus the decision to build green field. The initial search for suitable sites covered the entire United States. The search was quickly limited to the Mississippi River near the Gulf coast. The economic logic was simple:

[9] From 1975 until approximately 1980, the company viewed the failure to site an east coast refinery as a great setback. Post-1980, the company's view of the value and opportunity of expanding the distribution network changed as a result of changes in the demand for petroleum.

[10] "Grassroots" or "green field" is a term of art referring to a new site on previously undeveloped land as opposed to an expansion at an existing facility or complex.

1. This was within the market area for the lowest cost suppliers of hydrocarbons.
2. Olefin feedstocks were available along a narrow belt which ran from New Orleans to Baton Rouge, Beaumont, Houston, and Corpus Christi. These production centers were interconnected with a well-established distribution network.
3. The product market was primarily east of the Mississippi with the greatest growth expected in the southeastern United States.

A contractor was selected by the coordinator to catalog potential sites. The site selection factors which went into evaluating a specific site once a geographic region was chosen included a set of basic requirements:[11]

(1) A local political and social environment which will accept a petrochemical complex.

(2) Usable land area of 2000 acres with an additional area not exceeding 3000 acres, if required, for a buffer zone.

(3) Waterway and terminal site to accommodate 35,000 ton, 38 foot draft vessels at the plant site, or within 15 miles of the site with right-of-way available.

(4) Fresh water supply of 2 million gallons per day initially, and an additional supply of 4 mgd of fresh or treatable water available for future development.

Secondary requirements included: availability of construction and operation labor forces, wage rates in the area, availability of utilities, accessibility to rail, highway, and air transportation, land cost, and other economic factors.

[11] Taken from a confidential report prepared for the company by a contractor in 1970.

The company tentatively selected a site in the region of interest and arranged to obtain an option on the land. Another blind contractor was used to obtain options thus keeping the company's name out of the transactions. This served to keep land prices down and to limit mobilization of potential opposition before a decision could be reached on the merits and feasibility of the site. The next step was an informal, in-house investigation of environmental and political feasibility. Based on lessons learned from the east coast siting attempts, the coordinator looked into local development history, tax structure, political structure, and environmental attitudes of the area. He verified that the area of the site was particularly "hungry" for new development and that the tax structure encouraged industrial development. Potential environmental problems such as wildlife and wetlands issues were determined to be unlikely. The coordinator confirmed his assessment of the feasibility in meetings arranged with community leaders and officials including the local government council, lieutenant governor, and highway department. Representing the company were the coordinator and a local company public affairs official. The presence of a local official, after the failure to anticipate local attitudes in the east, was thought to be particularly important in order to contribute knowledge about the local institutional structure and to lend credibility. The primary purpose of the meetings was to gain local and state support. A secondary objective was to gather information about potential conflicts so that these issues could be addressed before they might arise. Applications for required permits (federal and local) were made, and the permits were obtained or all major hurdles (i.e.,

public hearings) were cleared before the options to purchase land were exercised. The project was canceled for economic reasons after the land was purchased. This represented the last major green field siting undertaken by the company to date.

Thus, the operating official who was coordinating the siting process had been delegated authority, and felt responsibility, to anticipate potential opposition. He did this through an informal information-gathering process with the objective of understanding local attitudes and political and economic institutional structures. The assessment, although not lengthy or detailed, was sufficient to establish confidence in the political feasibility of the proposed facility. Moreover, the coordinator had the authority to modify standard practices such as the time at which options to purchase land were exercised. This behavior is consistent with that predicted in hypothesis 1. No compromises were necessary or considered because no opposition arose. The lack of opposition was based, in part, on careful site selection to limit potential conflict from the outset and on luck--the desirable site was also in a politically supportive environment.

A minor facility (a pesticide formulation plant) was sited and developed in the midwest in the period 1976-77. Although no opposition was expected, upper management had become convinced of the longevity and influence of public activism. Throughout the development of the formulation plant, the establishment and maintenance of a sound posture of environmental protection was emphasized as a way of assuring community support. Unlike petrochemical facilities, a formulation plant is labor intensive and does not require highly skilled labor. Notwithstanding a well-established formulation industry, the company

officials decided to build and operate their own formulation plant. This decision was driven by a formulation industry reputation for use of construction and operation shortcuts and cheap labor. That is, the company officials could not be sure that they could find anyone to do the formulation in "an environmentally sound manner." In addition, the volume of the proposed facility would tax the capabilities of most in the formulation industry. Two locations were considered. Political and environmental feasibility of the two locations were judged to be about the same, while labor was expected to be more difficult to come by at one of the locations. Thus a decision was made based on labor availability.

The facility, sited in the center of the pesticide market (and in the center of cornfields) did not generate any local or state opposition. To insure limited, if any, opposition and consistent with a developing corporate culture which links long-term profitability with good community relations and environmental protection, the operating officials established a zero effluent limit which was more severe than required by law. In accordance with another self-imposed requirement, rain water is collected and used in the formulation process (rather than allowed to run off) to further guard against undesirable environmental impacts.

By 1976, then, anticipating and limiting external opposition had become routine responsibilities of company officials charged with siting and developing industrial facilities. Sufficient authority rested with operating officials to define the proposed facility in a manner which could be expected to establish and maintain positive interactions with the local community. This authority was supplemented with corporate

guidance (e.g., a firm corporate posture and internal guidelines on environmental protection) about how such authority should be exercised. Again, it is impossible to determine whether the company's actions would have been sufficient in a more hostile environment.

The increasing sophistication with which the company considers environmental and political feasibility in siting and developing major capital facilities can be seen in two ongoing expansion/modernizations on the west coast. The desirability of expanding and modernizing were first explored in 1977.[12] The company's past experience and the experience of competitors suggested that secrecy hindered the establishment of a positive community presence, exacerbated potential opposition, and hindered their ability to gather information to evaluate political and environmental feasibility. Therefore, the first step was to inform the California office of permit assistance of the company's desires and to solicit their assistance. A meeting was arranged with all interested agencies (those with permit authority and those with other interests). Also present at the meeting were representatives of local environmental interest groups. The scope of required documentation and a decision about a lead agency were made as a result of this meeting.

The positive advantages of anticipating potential problems and resolving them before they surfaced had been recognized as complementary to openness and candor. A highly interactive and iterative decisionmaking process had developed at the company during the early and mid-1970s (see next section) which significantly enhanced the company's

[12] Because of the needed modernization and interaction of proposed new facilities with existing units, a green field site was never considered.

ability to anticipate contingencies. The team process was particularly helpful in these expansions as a way of integrating the knowledge and capabilities of the headquarters staff with those of the location managers. For example, the initiative for early announcement of desires and involvement of governmental and community groups came from headquarters. Yet the meeting with the office of permit assistance and future meetings with outside groups were formally convened and accepted by the location manager. Headquarters initiative was needed because neither the location managers nor anyone on their staff had needed to obtain permits before. As a result there existed some "fear of the unknown" and a somewhat "entrenched" attitude. The transition from reticence to acceptance on the part of the location managers was accomplished, without undue difficulty, through the consensual team process. In addition, the transition was aided by a strong and experienced environmental staff established after the last major facility development.[13] Present, then, at the meetings and internal deliberations, were (1) individuals who brought general knowledge about the potential environmental and political problems and appropriate solutions and (2) individuals with the detailed knowledge about specific contingencies, interests, and leadership in the communities.

A major issue of concern to the company was environmental feasibility. Questions of feasibility arose because of the general strength and sophistication of the environmental movement and because of local histories near each complex of successful environmental opposition to industrial development. For example, in the mid-1970s, two chemical companies, accompanied by controversial and heavy press coverage,

[13] Again, see next section for details.

withdrew proposals to build petrochemical complexes in the San Francisco Bay area. In the late 1970s, a liquefied natural gas terminal failed to be approved in Long Beach.

In order to address the concern over environmental feasibility, a team at each location developed a tree of decisions necessary to obtain required permits. A comprehensive (and lengthy) list of necessary contacts at the federal, state, and local levels was assembled. Governmental contacts as well as trade association, labor, and community leaders were identified. Concentration was on political and institutional structure and not on "public" interest group leadership. The information that would have to be disclosed or which was desirable to disclose at each stage was also identified. The complex managers, with support and encouragement from headquarters staff, started talking informally with important actors in order to develop support for the project and to understand potential hurdles. Substantial effort was expended to anticipate all possible difficulties and transaction (or institutional) costs. Concurrently, engineering and planning units at the company's headquarters did the design work necessary to apply for permits. Potential public opposition was expected to be limited by early and candid meetings and by the excellent record of the existing facilities. Any actual opposition was expected to be resolved through environmental permit approval processes. Concurrently, all required environmental statements plus additional statements which company officials believed would secure approvals were prepared.[14]

[14] At one location, an environmental impact assessment was prepared notwithstanding an opinion by the permitting authority that none was needed.

Permits were obtained after the company made a few modifications (or concessions) to the proposal. For example, at one complex a \$70,000 walkway was constructed to permit scenic access to wetlands on property. Some minor architectural changes and landscape changes were also included. More importantly, 2.5 acres were annexed by the community for "fire protection." While company officials questioned the fire protection value, the annexation did increase local tax revenues. In return for changes made at both locations, the company "didn't lose a day" and maintained excellent relations with the surrounding community and local and state agencies. The changes did not affect the competitive position of the company.

The executive officers waited until permits were in hand before submitting the proposal to the board of directors for approval. Within 12-18 months after the project was defined, the line staff was convinced of the economic, political, and environmental feasibility of the proposed expansions. The upper-middle managers supported going to the board for approval at this point. But the history of successful environmental opposition to heavy industrial development in the areas surrounding both sites made upper management reluctant to send the proposal forward to the board of directors for approval. The internal debate about the environmental feasibility of the project was resolved once the permits were obtained. The recommendation to commit capital funds was sent to the board and the first phase was funded in the spring of 1980. This was approximately 24 months after the decision to meet with public agencies.

Thus, the company's siting approach has changed substantially over the period from the late-1960s to present. The mid-Atlantic site was selected based on economic and technical criteria, land was purchased, and construction was expected to begin almost immediately. There were no internal deliberations about the political or environmental attitudes of the region or community. The process was highly secretive; public announcement was not made until the last possible moment as a way of denying information to competitors. The company spent no time anticipating external obstacles or developing contingency plans or solutions. As a result, upper management had to devote time "fire-fighting" in order to try to save the project. The company viewed this as a public relations task and was therefore relatively inflexible in responding to community opposition. (Of course, it is not known whether the opposition could have been overcome even if the company had been flexible in response.)

The west coast expansions demonstrate (1) considerable learning from past experience, (2) delegation to operating officials of authority to anticipate and limit opposition and to settle conflict after it occurs, and (3) an ability to balance institutional factors with economic and technical requirements. The company has developed a strong internal network at the operating level which routinely anticipates and responds to potential external opposition or obstacles. The individual officials draw knowledge and experience from others within the company and from their past experience. They confirm and expand that knowledge through discussions with outside leaders. Candor and early involvement of the community have replaced the earlier secrecy. Importantly, the

operating officials have the authority to make binding commitments during meetings and permit approval proceedings. They are not constrained by rigid decision rules or statutory authority. The redirection of less than one-tenth of one percent of project funds (e.g., a \$70,000 walkway) in order to gain approval for a major project is fully within the authority and interests of operating officials.[15] An official does not have to consider the national or even regional equity of such a decision, only its effect on the schedule and projected costs of the project. An official who can gain approval for a project with such a small investment is likely to be rewarded by his superiors and is not subject to scrutiny by the public.

ORGANIZATIONAL STRUCTURE AND DELEGATION OF AUTHORITY

Organizational changes within the company were vital in enabling it to learn from past experience and to successfully expand existing facilities in environmentally sensitive areas. Management and organizational changes were, in part, responsive to unsuccessful facility development experiences. Importantly, they contributed to the capability to (1) understand diverse points of view, (2) anticipate and respond to the external environment, and (3) delegate decisionmaking to line officials coordinating and managing the development activities.

[15] Company officials had different attitudes toward use of "concessions." Those who had worked on projects which could only go ahead with the use of some concessions, such as the west coast expansions, expressed the view that concessions were necessary and expedient if they did not delay the project or raise the cost unacceptably. Some officials who had worked on projects in politically supportive environments viewed the use of concessions with disdain. It is unclear whether the attitudes are a product of experience or whether the personnel assignments took into account preexisting attitudes. I suspect it is a combination of these factors.

The company is divided into two largely autonomous organizations: (1) exploration and production and (2) products. For this research, we are only concerned with the products organization. Administrative or staff offices such as corporate planning, public affairs, general counsel, and health, safety, and environment support both the exploration and products organizations. Today, the products organization is structured in a matrix fashion--along one side of the matrix are functional units, and along the other are business centers.

Functional units are responsible for engineering, building, and operating facilities as well as for basic and applied research. Along the functional axis of the matrix are (1) a vice president for operations who is responsible for oil logistics, chemical logistics, and marine operations and (2) a vice president for technical functions who is responsible for engineering, research and development, and plans and analysis.

Business centers have marketing, sales, and profit and loss responsibility for individual product lines. Managers for product lines report to separate vice presidents for oil products and chemical products. According to company documents, business centers are:

responsible for the planning, strategy, and profitability performance of the various product and regional businesses. This responsibility does not stop at the business center boundary but includes all the support investment that may be required....

The business centers are accountable for the conduct and financial health of the business even though plan implementation and cost control administration rests with the functional organizations.[16]

[16] From documentation provided while at the company's headquarters.

Plans and analysis units (reporting to the vice president, technical) manage individual projects in order to coordinate the activities of the functional organizations with the business centers and with the rest of the corporation. All officials interviewed were located within the functional units of the products organization or within staff offices supporting the products organization.

The products organization is highly decentralized. Officials described a work mode that pushes decisions down to a level where they can be dealt with. That is, line officials four, five and six levels from the Chief Executive Officer (CEO) with direct responsibility and knowledge about an issue are expected to take steps to identify and resolve problems. According to one mid-level manager, the "zones of reporting almost disappear" at the middle- and upper-middle levels (i.e., four to six levels below the CEO). In other words, managers communicate laterally and vertically as required to gather or convey information about projects without regard to formal lines of authority. Most of those interviewed estimated that only one percent or fewer decisions or recommendations sent to the appropriate vice president for approval are rejected. This was confirmed by a vice president.

Work is conducted on a project or proposal basis, and each project is supported by a project/venture team. Teams are formed for all major and minor projects. The composition of the team draws from the matrix structure of the organization and also depends upon the technical and resource needs of the project. Typically, a facility development team will include approximately 10 managers from several organizations within the company including:

- the appropriate business center(s)--to represent the types of facilities needed
- engineering--to perform design work and other necessary technical components
- health, safety, and environment--to make sure broad environmental and safety requirements and policies are met
- environmental conservation--to design specific control and safety systems
- government relations
- employee relations
- plans and analysis--to coordinate all aspects of the project
- other units as needed

Capital projects requiring one year of effort or more are managed by officials in the Plans and Analysis units.[17] These managers refer to themselves as "team coordinators." The manager makes sure that, for his project, all functional and business aspects (e.g., sales, marketing, distribution, engineering, and operations) are accounted for and that all inputs and perspectives are accounted for. He serves as an internal and external focal point. For example, the "coordinator" for the proposed petrochemical complex discussed in the previous section is a plans and analysis manager. In addition to being responsible for anticipating and overcoming opposition, he also managed or coordinated the other aspects of the proposed development.

[17] Projects lasting under one year are handled by logistics units.

One plans and analysis manager described the company telephone book and organizational chart as his bible. He makes sure that all those who would be likely to have an interest, concern, or contribution to the project are contacted. The alternative is to run into unanticipated problems or obstacles--internal or external. Special effort is made to include those who have outside contacts and different perspectives or types of information. Public affairs, environmental affairs (line and staff), and employee relations officers are brought into every project from the outset. Projects are not sent forward to higher levels until all problems are thought through and resolved. Single-page status reports of anticipated schedules and costs are sent forward to the appropriate vice presidents quarterly. Unscheduled single-page reports point out changes in project scope, cost, or newly identified problems.

There are three interesting consequences of this team process. First, decisions are slow. It requires time to make sure that all potential problems and perspectives are accounted for and to reach mutual agreement at a middle-management level about the appropriate course of action. Thus, the products organization can be described as conservative. In the words of one manager, it is "difficult to do things in a hurry but it is also difficult to do things wrong."

Second, a team process and decentralized decisionmaking obscure where a decision is made and encourage cooperation. When discussing the siting process and its component decisions, none of those interviewed used the term "I"--as in "I decided" or "I thought." Instead, it was "we decided" or "we thought." When queried in more detail about where a particular decision was made (e.g., a zero effluent level at the midwest

formulation plant) or the scope of individual authority, it became obvious that the decisions discussed went beyond the authority or expertise of any single individual. Of course, there are some formal lines of authority. Formal jurisdiction is often defined by the amount of funds which can be committed without higher approval. For example, within some overall budget authority executive vice presidents can commit monies less than \$10 million. It also was clear that in the minds of operating officials, while major commitments are confirmed by upper management, they are reached by consensus at middle- or upper-middle management levels.

Third, consensual decisionmaking encourages lateral communication. The scope of a project manager's authority is limited; that is, his ability to take independent action is limited. Yet he is evaluated according to the performance of specific projects or activities. Therefore, he is dependent upon the cooperation of other officials in the successful performance of his duties. Thus, informal incentives for effective lateral communication are built into the system. Reinforcing this aspect of consensual decisionmaking, the performance reviews of plans and analysis managers emphasize the effectiveness with which coordination takes place and whether all contingencies are accounted for.

The team process is also highly iterative. There are some formal sessions where team members sit together in the same room. More often the communication is informal and between two or more team members (but less than the whole team). This approach limits time and bureaucratic aspects and encourages collegial cooperation. The key is the project manager or coordinator. He is the only one who sees all aspects of the

project and is in communication with all parties. The project gradually takes form and changes form as it progresses. It is not usually possible to determine the impetus for change or when a reformulation began. Instead project phases are identified by decisions to commit funds, e.g., funds to contract out data gathering or to purchase options.

The products organization was not always as it is today. In the late 1960s products was not a matrix organization. The oil and chemical product components were separate and completely independent.[18] A former executive vice president for chemical products was instrumental in the transition to the current management structure. Formerly, the responsibilities were divided into product divisions with full responsibility for functional areas such as research and development and engineering as well as finance, marketing, and profit and loss control. Thus, there were separate technical units for each line of chemical and oil products. Little communication existed between the technical or business staffs of different divisions. Yet, the general managers were judged according to short-term profitability. Thus, little was spent on operation, maintenance, and research. This was impairing long-term profitability and operating capability and was starting to create significant business problems.

In response, the executive vice president began an effort to create understanding among a few key individuals of other perspectives and opportunities. He accomplished it in a gradual manner by starting to

[18] Originally, the separation of chemical products from oil products was beneficial. The chemical divisions had riskier investments because of cyclical products markets and therefore could not have competed equally for corporate resources had the product lines been fully integrated.

rotate officials among the divisions and between functional and business responsibilities. The first step was to replace the oil manager with a manager out of the chemical division and vice versa. (After the products organization was integrated into the current structure, the two managers were replaced with a single location manager for both complexes.) Rotation of managers among the functional units and between chemical and oil product units, once uncommon, became commonplace. Thus, the stage was set for the executive to reorganize the chemical division into a matrix structure. This happened in 1972. The practice of rotation continues today.

Shortly after chemical products was formed into a matrix, a new executive vice president[19] transformed oil products into a matrix structure also. In 1975, oil and chemical operations were consolidated into the current products organization.

Two other organizational changes which took place during the 1970s were also in response to perceived business shortcomings. First, an "old-time ad man" was replaced as vice president for public affairs by an engineer out of the refinery organization. This personnel change came at the time senior management perceived that public activism was harming the company's ability to do business. This was in approximately 1969 or 1970 when the company was being shut out of the east coast market by the lack of a regional refinery. The new vice president organized an environmental affairs department whose responsibility was to understand and develop responses to the emerging environmental movement. Second, in response to the increasing sophistication and influence of the environmental movement, the profile of environmental

[19] The former executive was replaced, upon retirement, by one of his principal vice presidents.

management was raised in the company once again by the creation of a new position for Vice President, Health, Safety, and Environment. This new organization was staffed with experienced company engineers who had spent considerable time in line units.[20] Part of the purpose of creating the new organization was to continue to introduce diverse perspectives into the decisionmaking process and to cultivate a corporate culture of environmental protection. This was accomplished by endowing the new unit with visible leadership, experienced and known internal spokesmen, and adequate resources. Complementing the corporate presence, environmental management and health and safety units are located in the line operations organization to contribute on a daily basis to project engineering and facility operations.

Personnel assignment, in addition to personnel rotation, seems to increase the company's ability to anticipate and respond to external opposition. The plans and analysis managers have been rotated through many functions within the company and, in the judgment of this author, are particularly tolerant of and responsive to diverse perspectives. For example, the manager for site development is the same person who, as a refinery-man was assigned to take over a chemical complex as part of the early gradual rotation, was then brought in as a management spokesman for the mid-Atlantic proposal, and later managed the siting of the proposed petrochemical complex. I suspect that it is not coincidental that the manager of environmental conservation operations, also an engineer with location management experience, demonstrated the greatest appreciation for the legitimacy of the environmental issues in the mid-Atlantic case and for the legitimacy of environmental issues in

[20] In addition, staff disciplines included bioscientists and chemists who brought a different orientation than that of the engineers.

general. According to one official, location managers are transferred if they are not able to productively interact with and respond to community values and perspectives. As a final note, recall the construction manager, also an engineer, who had little appreciation for other points of view and who worked in a position which requires no public contact or understanding.

In a related management practice, the company has a policy of promoting from within. All eight interviewed from the products organization were engineers and had no appreciable experience outside of the company. Each had spent over 20 years with the company. This is typical of the staffing in the organization. All the executive officers are career company officials. This results in a long institutional memory and the ability to personally learn from past corporate experience. I note that most of those interviewed spoke knowledgeably and confidently about the company's siting history. Recollections, often supported with documentation, were also confirmed by at least one other official.

Thus, there are a combination of important organizational changes and management practices which provide evidence in support of all three hypotheses of Chap. 4. The managers responsible for day-to-day facility development have responsibility and authority to anticipate and resolve external opposition. This is evident in the decentralized nature of the organization, the existence of project teams, and formal internal incentives for anticipating contingencies. In addition, several factors prevent company managers from developing a single point of view and reinforce the incentives to understand and respond to diverse perspectives, goals, and values both from within and outside the

company. For example, staff is rotated among functional areas, the teams are drawn from a well-functioning matrix organization, project teams participate in consensual and iterative project development, environmental units exist in both the staff and line organizations, and managers are promoted from within. This combination of factors enables the company to respond flexibly to external opposition.

The assignment of responsibility for all facility development functions (such as engineering, institutional issues, distribution, sales, and construction) to a single manager, along with authority to make binding commitments to potential opponents, facilitates the balancing of institutional, economic, and technical objectives and factors. Moreover, the trade-offs which the manager makes (supported by concurrence of team members and upper management) are balanced against profitability of the project and are not subject to scrutiny by the public. Mechanisms for scrutiny are largely absent, nor are the private company's actions expected to be in the best interests of the entire society.

Finally, the ability to institute a gradual corporate reorganization, to promote from within, and establish other management development practices, reflects a stable organization and managerial commitment. The internal stability of the facility development projects and of the company is unaffected by short-term national political agendas or changes in administration.

THE SITING PROCESS

The current siting process evolved from both past experience and changes in management practice and organization. This section examines a static photograph of the current siting process.

Project definition arises out of a recognized need or opportunity. Depending upon the source, such need or opportunity might come from either the functional or business side of the matrix. For example, a business center might identify a growing product market. To respond to this need they may purchase at wholesale, expand capacity, or both. Alternatively, research engineers might recognize the opportunity to reduce operating costs through employing newly developed or adapted technology. The project takes on definition through cooperative efforts of the business and functional units regardless of its origin. The first question is economic feasibility. A decision to formally investigate a proposed opportunity is made by a vice president by placing it on a 10-year planning instrument.[21] At this point, it becomes a formal project and is assigned a project manager out of plans and analysis. At the early stages of the project when it is still undergoing feasibility assessments, reviews (formal and informal) are frequent. Once permits are obtained, capital funding is authorized, and construction has begun, reviews are infrequent. The project is defined as a green field project or expansion. The decision is largely a function of the cost in time and potential for incorrectly understanding the social, economic, and technical infrastructure of new versus existing locations.

In the case of a green field plant, a geographic region of interest is defined. The choice is made on economic and technical criteria.

Important factors include:

[21] Projects on the 10-year plan compete first within oil regional (east/west) categories or within chemicals for a ranking. Then top-ranked projects compete against each other for corporate funds. Final determinations are made by the General Executive Office and confirmed by the Board of Directors.

1. closeness to the product market
2. availability of raw materials--closeness to the factors markets
3. availability and cost of transportation
4. technical port requirements and the like

After the project gains a place on the 10-year plan, there is a lengthy assessment/project evolution phase. There are several distinguishable screens which are employed in arriving at the decision to commit capital funds.

First, if the project is defined as a green field project, a contractor is employed to catalog and evaluate potential sites within the region of choice. The first order criteria are similar to, though more sophisticated than, the criteria used in 1970. Namely, (a) political feasibility as defined by the tax structure and political structure of the state and community, (b) elimination of insurmountable environmental obstacles such as wildlife refuges, national parks, and so on, and (c) technical feasibility such as availability of adequate port facilities, labor, utilities, water, and so on. As a result of this screen, a contractor will be employed to purchase options to promising real estate.[22]

The second screen (or first screen, if a major expansion) is an in-depth political and environmental assessment. This is conducted in-house. If it is a green field project, it might be led out of headquarters. In any case, managers of nearby facilities will be asked to provide input about local attitudes, leaders, and institutional

[22] The company has not purchased options for multiple sites in the past. Instead, a single desirable site has been chosen.

structure. If it is an expansion, the assessment will be led by the location manager with significant cooperation and assistance from headquarters officials. A plans and analysis manager acts as overall project manager. Informal meetings will be held with permitting agencies, environmental interest groups, community leaders, labor leaders, and other important actors. Input will also be requested from all within the company who might contribute to the identification of potential contingencies or solutions. The emphasis during this assessment phase is to accurately anticipate all potential problems which might arise and to develop solutions. During this screening process, emphasis is placed on passive information gathering. Although meetings are held with community leaders about the company's plans, the purpose of the meetings is not primarily reconnaissance. Instead they are informational. Primary reliance for anticipating obstacles is placed on the combined experience of company officials. Outside contractors will be employed to perform certain routine data gathering tasks or environmental surveys and assessments.

A third screen is the permit approval process itself. During this screening process much of the information gathering is of an active nature. Trade-offs and negotiations are conducted in the course of the permit review. The company relies on the conditions stated for approval in order to identify the final modifications which might become necessary to go forward. For example, the decisions to allow land to be annexed or to build a park area in the west coast expansions were made as part of the permit approval process. If conditions are technically unacceptable or violate corporate standards of integrity[23] they will

[23] For example, the corporation would not offer bribes or accept other illegal or unethical conditions.

not be accepted and the project will be aborted. If conditions are within limits of economic feasibility and they do not compromise the integrity or safety of the project, the company will usually accede.

As part of the second and third screens, the company makes an effort to establish a positive presence in the community. This is accomplished by early meetings with permitting agencies and community leaders and through complete disclosure as soon as purchase options are secured. In the words of one official, he wants to be a reasonable person: "to admit when we're wrong and stick up for what's right." The company also seems to stress a posture of "good citizenship" and environmental protection. Internal guidelines state that "the health and safety of our employees and protection of the environment must be primary considerations as plans are made and before actions are taken." [24] This corporate attitude is reinforced by the presence of line and staff environmental units, by their inclusion on project teams, and (according to interviews with headquarters officials) by the effective aid they have given location managers in anticipating and resolving problems.

Once permits are obtained and if the final return on investment assessment remains promising, the project is sent forward to the board of directors for authorization and appropriation of capital funds.

It is important to note that most of those interviewed believe that at the present time, environmental and political factors are minor in

[24] Internal guidance dated November 5, 1981. For example, engineers with support from environmental units are expected to design in all safety and environmental control features without regard to economic feasibility. If the safety features "kill the job," then so be it.

corporate decisions about whether or not to build any particular facility. I suspect that this reflects:

1. a highly integrated and iterative decisionmaking process which seeks to routinely understand and respond to opposition in the external environment;
2. the geographic reality that many of the company's product and factor markets are within regions which historically welcome industrialization;
3. the use of expansions rather than green field development in less supportive regions which eliminates the need for purchasing land and rezoning and contributes in-depth knowledge about local attitudes and institutional structures; and
4. the good neighbor posture and efforts the company has taken to establish a positive presence at operating facilities.

VII. FINDINGS AND POLICY IMPLICATIONS

This research offers evidence that federal executive agencies are severely hindered if not incapable of siting noxious facilities. This results from the ways in which society exercises scrutiny over executive agencies of the federal government. The set of factors which comprise the institutional environment of federal agencies include: the means for control and accountability to individuals and groups outside the agency; the nature and clarity of goals; and the access to economic resources. These factors create organizational behaviors which adversely affect the ability of executive agencies to develop the capabilities necessary to site noxious facilities in the face of external opposition.

Chapter 2 outlines the following organizational requirements for successful siting of noxious facilities in the face of opposition:

1. the capability to monitor continually the external environment; respond differentially to different tactics and sources of opposition; and modify plans and strategies in response to changes in the external environment or improved information about the environment;
2. the capability to delegate to operating officials day-to-day interaction with external groups (including the authority to negotiate solutions) along with guidance from upper management about the limits of acceptable responses;

3. the capability to balance technical, economic, and institutional factors in location and design decisions; and
4. the establishment of a stable policy over the entire period of facility development.

I have compared the ability of a private company to develop the capabilities required to site a noxious facility in the face of opposition with the ability of an executive agency to develop similar capabilities. The purpose of the comparison is to evaluate whether the differences in the set of mechanisms for scrutiny, nature of goals, and access to resources are important determinants of success in siting. It is important to notice that the procedures of officials in the DOE and the private company differ in degree but not in kind. For example, both rely on formal meetings in order to gain support for proposed activities. The primary purpose of the meetings for both organizations is to communicate the organization's plans. In addition, both organizations rely on third-party rulings in order to settle any actual opposition. The DOE expects that conflicts with state governments will be settled by congressional or presidential rulings. Similarly, the private company relies on formal environmental and land-use permit proceedings to settle conflict with external groups by specifying conditions for project approval.

Notwithstanding similar conceptual approaches to conflict resolution by the two organizations studied, this research suggests that, while private companies will be able to develop capabilities necessary to site controversial noxious facilities in the face of opposition, executive agency siting programs will not develop these

capabilities. On the contrary, federal program managers of controversial siting programs find flexibility to modify their programs in response to external opposition illusive. Individuals and groups whose interests are adversely affected by the siting of a proposed noxious facility are able to exercise scrutiny over the process used by program managers to make programmatic decisions. Points at which outsiders can influence policy, affect appropriation and authorization of funds, and demand access to information about alternatives considered, formal dissenting opinions, and decision criteria are frequent and numerous. The high visibility of and competing demands placed on controversial siting programs reinforces incentives for political officials to retain authority over distributive, equity, and nonroutine issues and to limit program managers' authority to operational issues. The same avenues of access and mechanisms for exercising scrutiny also reinforce incentives for operational decisions to be based on somewhat inflexible decision rules. Such rules and procedures rarely take into account the special circumstances which influence the local or regional interests in an individual site. Moreover, without incentives, authority, or guidance, program managers will fail to collect and evaluate information about potential opposition which arises from distributive issues and value differences. Yet distributive, equity, and value issues form the basis for substantial opposition to noxious facility siting. What are traditionally considered operational decisions such as facility design and site characterization affect the level and intensity of potential opposition. Thus, programmatic decisions affect the ability to implement a given siting proposal in the face of opposition but are not informed by

knowledge of political and institutional factors. On the other hand, the flexibility available to political actors within or outside the agency is too crude and not generally informed by the details of specific issues to limit or respond to opposition from outside the agency.

The same combination of factors which limits the flexibility available to program managers also limits their ability to balance multiple noncommensurable goals. The siting and development of a noxious facility are often made a public responsibility because of the desire that public interests take precedence over private interests. Yet public interests, even those which seem as clear as protection of public health and safety, involve multiple goals which defy a common metric for evaluation. Moreover, what amounts to a benefit for one set of individuals may be considered detrimental by another set of individuals. Individuals and groups whose interests are adversely affected by a proposed facility can employ multiple avenues of access to influence political decisionmaking (e.g., appropriation and authorization of funds and policy definition) and to scrutinize programmatic decisionmaking. These groups attempt to place pressure on political actors to act upon singular objectives without consideration of conflicting interests of other actors.

Finally, the multiple points of access to political decisionmaking, combined with the perceived need by political actors to respond to pressure in the short term (before the next election), result in frequent policy redirections for controversial siting programs. The result of frequent policy redirections is to frustrate program managers and reinforce short-term considerations often to the detriment of long-

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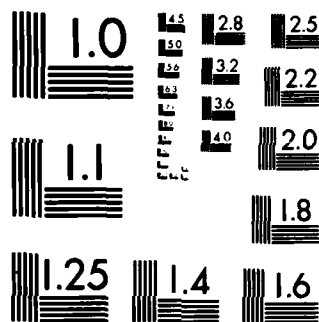
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term planning--frequent program redirections necessitate numerous reformulation of plans. Second, the credibility of the agency is undermined if promises and plans are reformulated frequently and appear to be responsive to political rather substantive considerations.

Private officials are subject to different mechanisms for accountability to individuals and groups outside the organization. The consequences of private decisions and plans are reviewed but the processes for making those decisions are less visible than in the public sector. Multiple objectives such as public safety, public participation, and speed of development can be treated by private companies as constraints on profitability. As such, they are (conceptually) subject to a common metric (dollars) and more easily balanced against each other. Finally, while political decisions and changes in public policy might make private decisions more or less attractive (e.g., because of the imposition or elimination of a subsidy or tax), outside actors such as the President or Congress exert little direct control over programmatic decisions of private companies. Thus, as a result of external institutional environments different from those facing executive agencies, private companies are better able to establish patterns of delegation of authority conducive to successful siting of noxious facilities. When operating officials have authority and responsibility to limit and respond to opposition (along with guidance from upper management about the limits of an acceptable response), incentives to monitor the environment for potential opposition can be established. This allows private operating officials to anticipate opposition and develop contingency plans. Moreover, operating officials are judged, in part, on their ability to limit and

respond effectively (economically) to such conflict. DOE officials, on the other hand, have less incentive to seek information or to take responsive actions. Private officials have data gathering techniques which are not available to the DOE such as the use of blind contractors and informal, nonpublic meetings. Importantly, private operating officials have authority to make binding commitments during meetings and permit approval proceedings. They are not constrained by rigid decision rules or statutory authority. Finally, private firms have the flexibility which is unavailable to executive agencies to rapidly redirect monies and efforts.

Obviously, firm conclusions cannot be drawn based on the two cases studied. In many ways the cases represent different siting problems. The siting of HLW repositories is much more difficult than the siting of petrochemical facilities. Repositories require pioneering technology which is not well understood by the public and has not yet been demonstrated to protect public health and safety. Moreover, issues involving potential radiation hazards are matters of scientific controversy and, importantly, generate public concern and emotion. Many consider even low levels of radiation an unacceptable risk, while fewer want to eliminate chemicals from their environment. The siting of repositories has a longer "critical path" than the siting of petrochemical facilities. Finally, surrounding the siting of repositories are controversial societal issues such as the continued generation of electricity through nuclear power and the nuclear weapons program. One cannot, and should not, conclude that the private company examined would succeed in siting a repository if given such responsibility. Some suspect that HLW repository siting will not be achieved.

Not only do the two cases represent different siting problems, but they also entail different societal goals. Disposal of hazardous substances, and notably disposal of radioactive wastes, falls within the governmental responsibility to protect public health and safety and to protect the environment. In such areas, the task is assigned within the political system as a way of assuring that nonmonetary and noncommensurable goals are balanced according to the checks, balances, and compromises which are part and parcel of the political system. Yet public control is exercised by a variety of different mechanisms.

The research provides strong evidence that the DOE, or any other executive agency, will not succeed in siting a high-level radioactive waste repository. Moreover, it suggests that a change in the mechanisms for accountability or the frequency and number of points where individuals and groups can influence or manipulate the policies, programs, and resources for siting noxious facilities is needed before federal agencies can develop requisite capabilities for successful siting of noxious facilities. I am not suggesting that the public absolve itself of responsibility for overseeing the program to dispose of radioactive wastes. Instead, I am suggesting that alternative means for exercising oversight be considered. This research does not provide answers. It simply raises the questions. Three general avenues for establishing alternatives means of oversight should be considered:

First, in the short run, responsibility for high-level radioactive waste disposal might be reassigned to a federal organization which faces a different set of mechanisms for accountability and control from outside the organization. For example, responsibility might be assigned

to a public corporation (as suggested by Willrich and Lester). Relative to executive agencies, public corporations are subject to a different kind of scrutiny which, in the face of external opposition, can result in greater programmatic and fiscal flexibility, a heightened ability to balance competing objectives, and more stable long-term policies. A public corporation, such as the Tennessee Valley Authority, achieves the public interest by acting within federal health and safety and economic regulation, and the charter contained in authorizing legislation. The corporation's performance is monitored by way of congressional oversight. A public corporation's funding can be obtained through charges and by revenue bonds without the need to seek annual appropriations. This will give the organization greater fiscal and programmatic flexibility. An institutional environment which is different from that facing an executive agency will result in different organizational behaviors and incentives. If formulated with organizational incentives in mind, a public corporation can be designed so that it is more likely to develop the capabilities required to site noxious facilities in the face of opposition.

Second, it makes sense to reevaluate the rationale for making high-level waste disposal a federal responsibility. The evident rationale is that protection of public health and safety over the length of time necessary to isolate high-level waste from the biosphere demands that public interests take precedence over private interests in profitability. But there are other permanent disposal activities of hazardous substances which, thus far, are still considered appropriately conducted by private organizations. Notably, hazardous waste disposal and low-level nuclear waste disposal are managed by private companies

subject to federal or state health and safety regulation. Because of the volume of hazardous and low-level wastes and the feasible disposal options available, these disposal activities present greater risks to public health and safety than does high-level waste disposal.[1]

According to this alternative, defense installations and nuclear reactors will create a market demand for waste disposal. Additional incentives can be created to encourage private investment in HLW disposal facilities. Public health and safety and consideration of appropriate disposal and siting alternatives can be assured through regulation by the NRC and EPA. This alternative would be consistent with assignment of responsibility for other hazardous disposal activities and would provide an institutional environment more nearly like that facing the private company studied in this research. While such an arrangement might help assure the programmatic flexibility and policy stability required to successfully site noxious disposal facilities, it would also substantially change the means for accountability to the public, Congress, and the President.

A third and much longer term alternative involves rethinking whether the tools provided public agencies are sufficient for some of the specific tasks assigned. In the case of siting of controversial noxious facilities, this research suggests that the tools are not sufficient. At this point, I cannot begin to outline what such a

[1] There has been some pressure to make hazardous and low-level waste disposal federal or state responsibilities. If this is done, agencies assigned disposal responsibilities will require the same capabilities required of the DOE or other organizations siting noxious facilities. Moreover, if assigned to an executive agency, the agency will exhibit similar organizational behaviors and incentives as described here and will therefore have difficulty developing requisite siting capabilities. Therefore, many of the arguments of this study should be applied to policy decisions affecting responsibility for hazardous and low-level waste disposal.

reevaluation would entail. Certainly, one of the first steps is to evaluate performance (or lack thereof) of executive agencies on a range of specific functions and to identify the determinants of good or bad performance. I suspect that a broad range of relatively new functions have grown up which are not well handled by traditional tools available to government officials. In the case of noxious facility siting, the environment has changed and a mix of old and new tools are poorly suited to what could be considered a traditional function--protection of public health and safety. Finally, new tools such as loan guarantees and federal oversight of state authority for traditional responsibilities may be poorly suited to traditional organizational structures (Salamon, 1981).

Any organizational modification will result in delay while responsibilities and players sort themselves out. The consequences of these alternatives or other alternatives have not been analyzed. The consequences of the present assignment of responsibility, though, are clear: (1) continued inability to limit and resolve opposition to program initiatives as a result of inflexible programmatic responses by operating officials and (2) problems of credibility and lack of trust in the federal program as a result of unstable policies.

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